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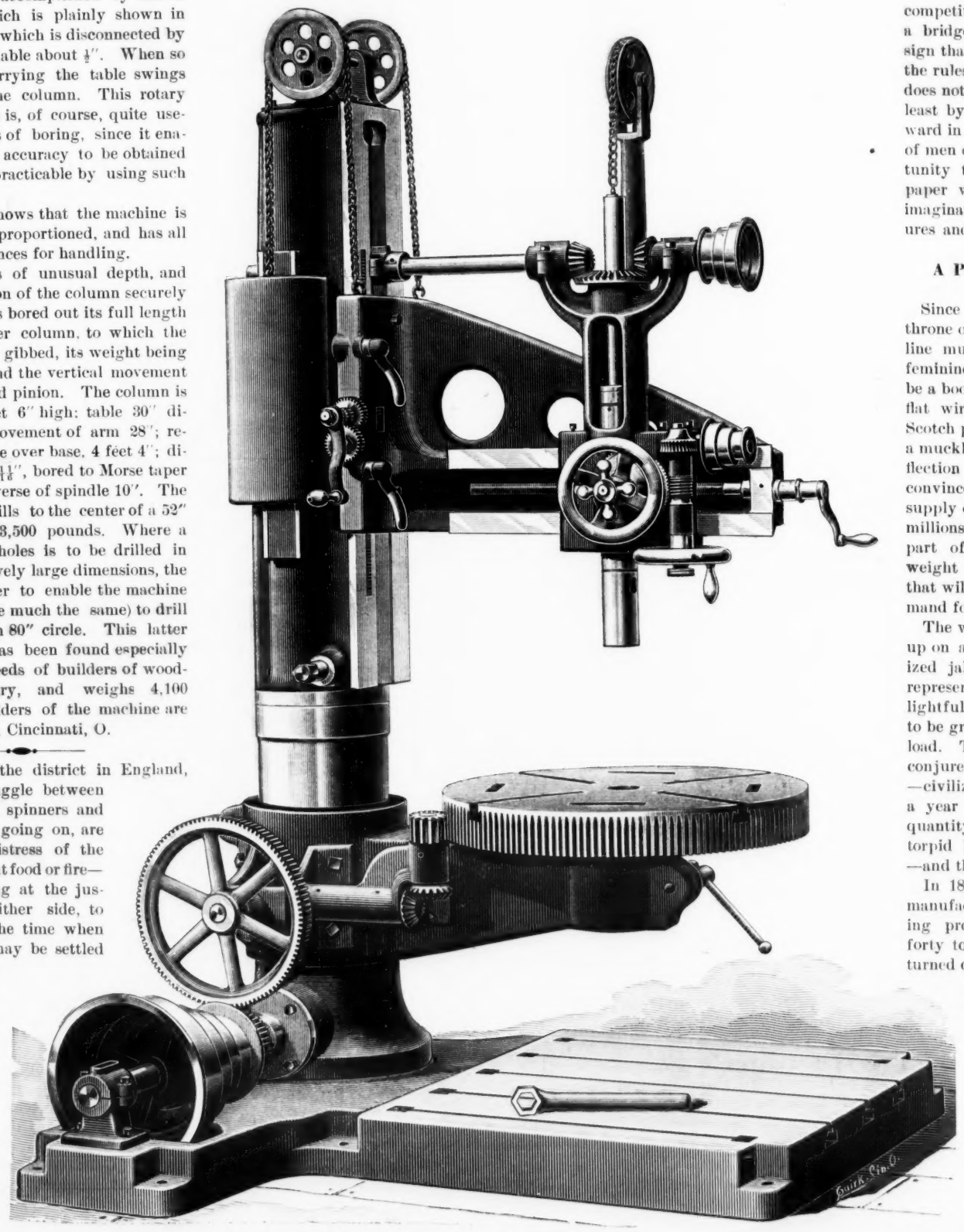
## Radial Drill with Rotating Table.

Our illustration is of a radial drill press, which, in addition to features that have been previously described by us, has a table which can be rotated in the opposite direction to that of the spindle, and at one-fifth its speed. This is accomplished by means of the gearing, which is plainly shown in the engraving, and which is disconnected by simply raising the table about ¼". When so raised, the arm carrying the table swings entirely around the column. This rotary motion of the table is, of course, quite useful for many kinds of boring, since it enables much greater accuracy to be obtained than is otherwise practicable by using such a machine.

The engraving shows that the machine is very substantially proportioned, and has all necessary conveniences for handling.

The bed-plate is of unusual depth, and has the lower section of the column securely bolted to it. This is bored out its full length to receive the upper column, to which the arm is fitted and gibbed, its weight being counterbalanced, and the vertical movement effected by rack and pinion. The column is 10" diameter, 6 feet 6" high; table 30" diameter; vertical movement of arm 28"; receives under spindle over base, 4 feet 4"; diameter of spindle 1 1/16", bored to Morse taper No. 4; vertical traverse of spindle 10". The machine shown drills to the center of a 52" circle, and weighs 3,500 pounds. Where a smaller range of holes is to be drilled in work of comparatively large dimensions, the arm is made longer to enable the machine (which is otherwise much the same) to drill to the center of an 80" circle. This latter style of machine has been found especially adapted to the needs of builders of woodworking machinery, and weighs 4,100 pounds. The builders of the machine are Dietz, Gang & Co., Cincinnati, O.



RADIAL DRILL WITH ROTATING TABLE.

Accounts from the district in England, in which the struggle between the master cotton spinners and their operatives is going on, are so full of the distress of the operatives—without food or fire—as, without looking at the justice or right of either side, to induce hope for the time when such differences may be settled without resort to strikes and lockouts. In the sober thoughts of any one how senseless such methods of settling differences must appear—methods that really settle nothing except the relative endurance of the parties concerned, and bring suffering to thousands, and starvation and death from exposure to many. The wisdom of men ought to be sufficient to enable them to find some better plan. The subject is worthy of more thought than has yet been given to it, although it received, at various times, considerable attention from well-meaning men.

## Mechanics as a Fine Art.

At a recent meeting of the Engineering Association of the South, the paper of the evening was presented by Prof. William T. Magruder, of Vanderbilt University. His subject was "Mechanics as a Fine Art." He showed that, while the Greeks are our masters in many of the arts, yet in mechanics and physics their notions were far from correct, owing to a supposed variance between theory and practice. He pointed out how prejudice governed men's minds then as now, and that to move ships on dry land, to burn fleets by the concentration of the sun's rays and the like for the benefit of the State, was of less importance in the days of Archimedes than some geometrical abstraction. After clearly drawing the distinction between science and art, he showed by example how an art to be a fine art must minister not to the material necessities or conveniences of man but to his love of beauty, and that the essence of all fine arts is the imagination, and that they cannot be produced or practiced by habit and calculation. The engineer or architect who starts to design a machine or structure scientifically must of necessity call the art of applied mechanics to his assistance. Having determined its outlines by a study of the requirements of the problem, having worked by calculation from the rules of the arts, the form, size and strength of its various parts, he has but completed the demands made upon him by a utilitarian age and the exigencies of business competition. To construct a building, erect a bridge or build a machine of such a design that, while it may be in accord with all the rules of the art, yet offends the eye and does not appeal to our sense of beauty, at least by comparison, is to take a step backward in our civilization, to insult the taste of men of cultivation, and to lose an opportunity to expand one's own mind. His paper was a plea for the freer use of the imagination and of the beautiful in structures and machines.

## A Probable Boom in Steel Wire.

Since the fiat has gone forth from the throne of the Goddess of Fashion that crinoline must henceforth be worn by all her feminine devotees, there will probably soon be a boom in the manufacture of round and flat wire for this purpose. It is an old Scotch proverb that "many a mickle makes a muckle"; and it only requires a little reflection upon the arithmetic of crinoline to convince any one that the maintenance of a supply of wire to encircle the charms of the millions of beauties that make up the female part of civilization, means an enormous weight of iron and an extensive industry that will last till fashion again gives a command for its extinction.

The writer once saw in a drug-mill, piled up on a floor, an enormous heap of pulverized jalap, and was assured that this pile represented only a small fraction of this delightful cathartic annually sent to that mill to be ground into powder. Jalap by the carload. Think of it! Can the imagination conjure up any article that the average man—civilized or savage—would want less of in a year than jalap? Yet even this small quantity, multiplied by millions of existing torpid livers, amounts to annual car-loads—and this in a single drug-mill.

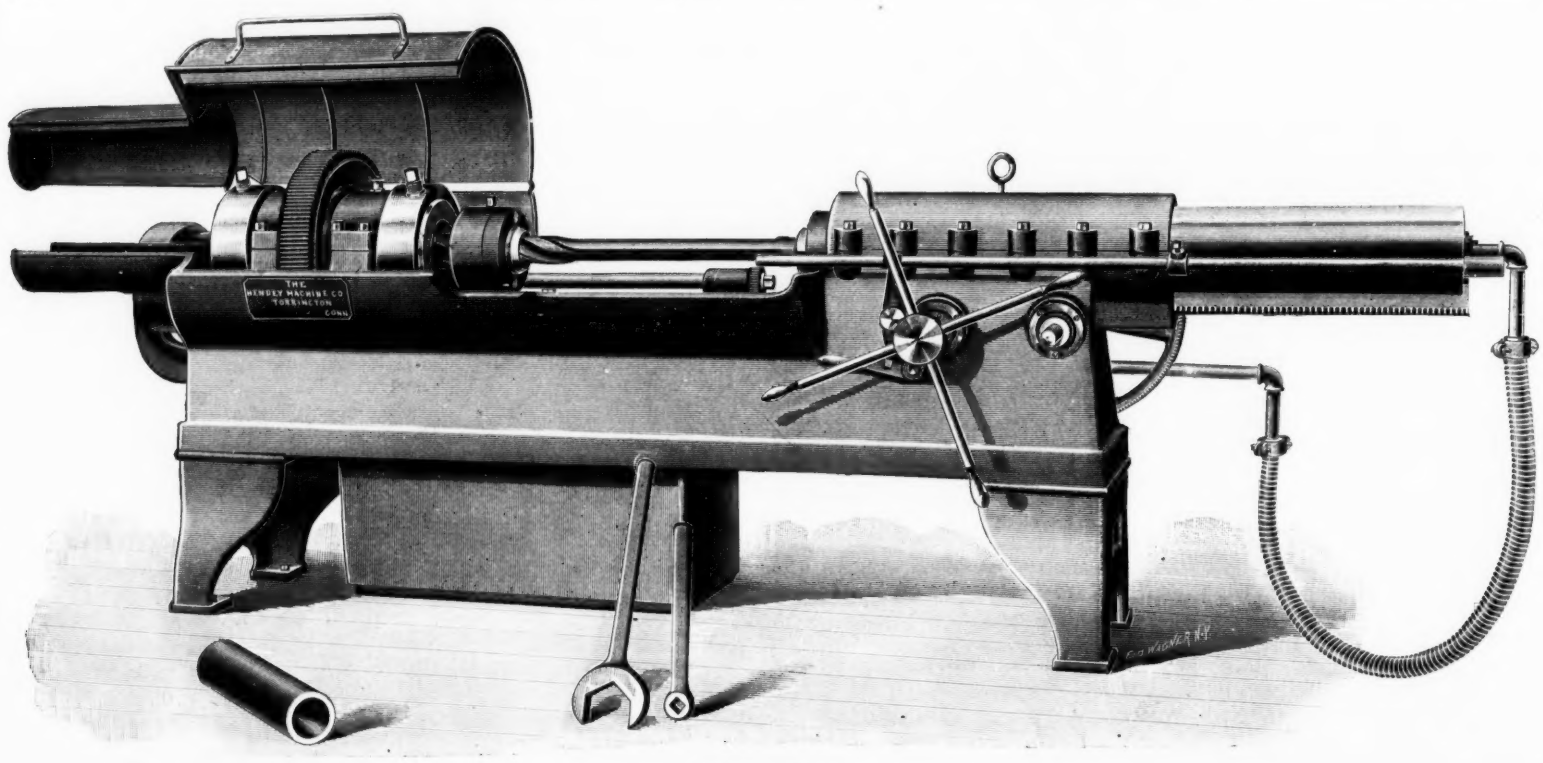
In 1861 the writer witnessed—in a large manufactory in New England—the interesting process of making shoe-pegs. From forty to 100 barrels of shoe-pegs could be turned out of this establishment each working day. It was asserted that this output was so far from that required for the supply of the world's markets as to only partly meet the wants of a single country, viz., Germany, to which land all the pegs made in that factory were at that time regularly shipped.

These examples show how a very little of any commodity demanded by each individual creates a very large industry. And if crinoline really gets to be fashionable, the amount of wire required to supply the demand will, in a single year, probably amount to more than that contained in all the wire suspension bridges ever erected. Much of this wire will be tinned or nickel-plated, and so the industries pertaining to tinning and nickel-plating will partake of the benefit arising from the revival of crinoline.

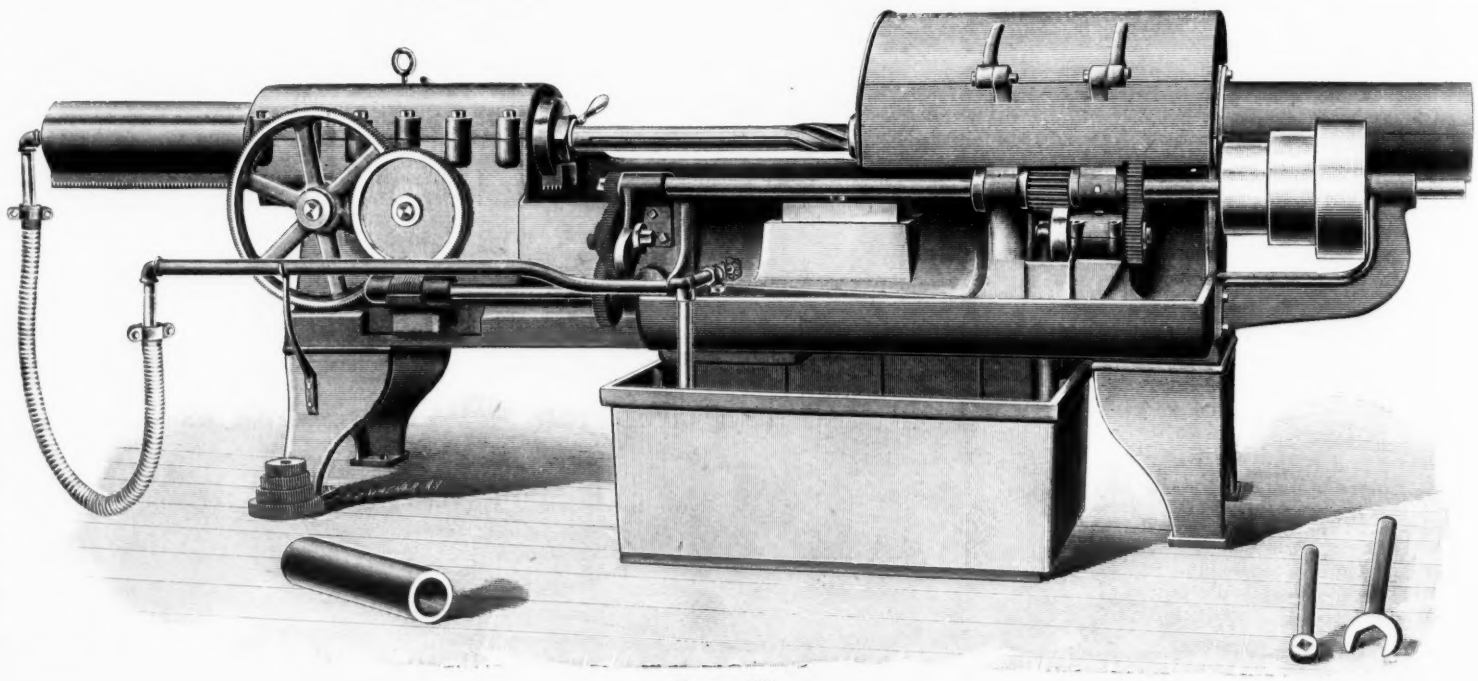
If, however, the plague of hoop-skirts be added to those of cholera and typhus fever, the latter already present with us, and cholera likely to come, the woes of our land will be comparable to those of Egypt when the Israelites were refused permission to depart.

## Horizontal Drilling Machine.

Modern machine construction seems to demand a constantly increasing proportion of what are virtually steel tubes, most of the machine tools of the lathe class being now made with hollow spindles, besides the use for such tubes which is found in hydraulic machinery, and in making rapid fire guns.




*Front View.*



*Rear View.*

Horizontal Drilling Machine.

To permit this drilling of steel tubes from the solid bar in the most efficient manner possible has been the object in the construction of the machine, of which we herewith present a front and a rear view.

The machine consists essentially of two heads cast solidly with the heavy bed, the head-stock carrying a very large and very powerfully-driven spindle, which has a hole through it to admit the largest work to be drilled. There is a chuck at each end of this spindle, these chucks being powerful and strong enough to drive and hold the work securely under the strain of the heaviest drilling; an idea of this strain and of the efficiency of the machine being obtained from the fact that the one illustrated—which is called the 4″x4 foot machine—will drill 30 inches per hour in solid steel with a 4″ twist drill, or 40″ with a 2″ drill or under.

The drills are provided with brass tubes soldered into a spiral groove, which leads them to the end of the drill, and through these tubes oil or other lubricant is forced at high pressure, so that perfect lubrication, freedom from excessive heat, and the clearance of chips are secured.

By reference to the engravings it will be perceived that both the driving and feed gears are so proportioned as to give ample power, and the pump is driven by gears. The hood over the head-stock and other devices are for the purpose of confining the oil within the machine when working. Larger or smaller sizes of the machine are built to order by the Hendey Machine Co., Torrington, Conn.

## Injector Notes—Ejector Condensers.

By W. H. Booth.

There are certain well-known facts in connection with the behavior of steam, which, though so well known, fail to be applied to practice. Some such facts I have indicated when dealing with the principles underlying the action of the exhaust injector, and I now propose to go further in the same direction, because I think that the behavior of the ordinary or live steam injector may be explained if commonly known facts are made use of to explain such behavior. A reference to a table of the properties of steam shows that at the atmospheric pressure the temperature of steam is 212°, and we know that steam has the same temperature as the water with which it is in contact and from which it is produced. We also know that if this steam be subjected to compression a portion of it will be condensed, because for steam to exist at a higher pressure than 212° its temperature must also be higher. In fact, every pressure has its corresponding temperature. It follows from this that if we allow steam at 60 pounds pressure to flow into a boiler at 30 pounds pressure there will be a condensation of the inflowing steam, for its temperature being nearly 293°, and that of 30 pounds steam being only 250°, there is a difference of 43°, and until sufficient steam has condensed to raise the temperature of the whole boiler to 293° there can be no increase of pressure to the 60 pound limit. Condensation of steam does not in fact require cold water, in the ordinary meaning of the word cold, but may be condensed by any substance colder than itself so long as the condensation take place under a sufficient pressure.

We do not look upon water at 190° temperature as a very efficient means of condensing steam at 212°, because we say the difference is too small for effecting a rapid condensation. Now the feed delivered by an exhaust steam injector has this temperature of 190°, and we know by the results of actual practice that this injector will feed against pressures up to about 75 pounds by gauge. Now when this injector is set to feed a boiler which carries a higher than 75 pounds pressure, there is an addition made to it in the shape of a supplementary live steam portion. Live steam from the boiler at, we will say, 100 pounds pressure, is admitted to the injector; its admission takes place at a point beyond that where the exhaust steam enters; it takes place, in fact, after the exhaust steam has done its work and set in motion a jet of water at a velocity greater than the equivalent of 75 pounds pressure. It is as though steam at 100 pounds with a temperature of about 338° were admitted into the presence of water at 190°. The difference is enormous, no less than 148°, and this really hot water acts perfectly as a condensing medium to steam at 338°. In this way the jet of water, already moving at a velocity sufficient to overcome 75 pounds, has added to it a further velocity acquired by the absorption of the motion of a small amount of high-pressure steam, sufficient to enable it to enter the high-pressure boiler. The economical value of the exhaust injector is thus secured as far as it can be, and the feed, thus heated to 190° by exhaust steam, gains a further accession of temperature from the live steam, and may enter the boiler very much above atmospheric boiling point. It continues to exist as water, simply because it is in a state of compression, and moving against a resistance greater than the pressure which corresponds with the temperature of the moving jet, though the discharge of the steam into the atmosphere would demonstrate at once the fact that its temperature was greater than that corresponding to atmospheric pressure.

This action might be carried to higher grades, and by the addition of still hotter steam to the moving jet a still higher velocity would be generated, the water jet under pressure always acting as a condenser of the hotter steam.

I have heard surprise expressed that an injector would feed water above the boiling point, and yet this admits of the above perfectly simple explanation.

There is a difficulty with pumps in working with hot water. Thus with water at 150° the pressure of the vapor is about 4 pounds, and if a good pump will ordinarily lift 25 feet with cold water, we could not expect it would lift more than about 16 feet with water at 150°. If water can only flow into a pump it will work easily, and a pump will work water from a boiling tank so long as this is above the pump. Where the pump must lift the water, of course the relief of the super-incumbent pressure from the surface enables the water to change into vapor, and the pump is filled only with vapor. In certain manufacturing operations, as in sugar boiling, this property is utilized to prevent discoloration, for a pan of juice kept in a state of partial vacuum will boil at a low temperature, and better results are thereby secured than can be got with open pans which cannot boil under 212° at or about sea level. It has long been known that a vacuum as high as 12 pounds could be obtained by the use of the ejector condenser which, after all, was the prototype of the exhaust injector, and consisted of an arrangement of cones which discharged the water of con-

densation into the atmosphere without the use of the customary air pump.

Discharging only against the atmosphere it was possible to work this form of exhaust injector with a steam pressure of only about 2½ or 3 pounds, corresponding with a "vacuum" of about 12 pounds, and doubtless we might figure on these data and discover that the final velocity of the mixed jet of water and of the steam condensed by it was amply sufficient to be fed against the atmospheric pressure of 14.7 pounds. The exhaust injector is simply an ejector condenser; it works with a vacuum of about 0 pounds, or simply atmospheric pressure, and feeds against five or six times this amount, just as the ejector condenser works with 2½ or 3 pounds of absolute pressure, and also feeds against five or six times this pressure.

Thus, if we figure on a vacuum of say 11.7 pounds and a condensation temperature of about 100° we shall have a working pressure equal to about .34 of a foot of mercury, or by our rule given previously, $P - p = .34$. Then the velocity of flow $= .1200 \sqrt{P - p}$, or nearly 720 feet. To overcome the atmospheric pressure of say 15 pounds the final jet velocity must be about 47 feet per second. Now $720 \div 47 = 15$. The final velocity is one-fifteenth that of the exhaust, so that theoretically each pound of feed water will move 14 pounds of condensation water; allowing for loss, probably the amount of condensation water would be about ten times the feed.

Now the exhaust steam in cooling to 100° parts with about 1,078 heat units per pound. The water of condensation in rising from 50° to 100° gains about 50 units and $1,078 \div 50 =$ say 21, which would indicate that the final temperature must be more than 100°, or the vacuum must be less than I have above assumed. A vacuum one pound poorer and a final temperature of 126° would bring the amount of condensation water required to 14 times the weight of feed. The figures are sufficient, at least to explain the action of this form of condensing apparatus, and to show the importance of cold water, for even at 100° the pressure of water vapor is one pound per square inch.

In the exhaust injector the condensing effect is not great because only a portion of the steam is used by it to feed all the water necessary for an engine. Indeed, if the condensing action were greater and the atmosphere were prevented from running back into the exhaust pipe the acting pressure of the exhaust steam would be too far reduced to allow it to do the work of feeding against a pressure of 75 pounds. Like all mechanical devices it has its limits, and more cannot be effected one way without corresponding differences in other ways which balance this. Hence, for boiler feeding, we get a maximum of 75 pounds fed against by simply atmospheric steam, and for condensing purposes we find a vacuum of about 12 pounds as good as can be secured when discharging against the atmosphere. This shows us that when using a condenser of the ejector type we ought, if we have one at hand, to lead the final discharge pipe over a cliff as a draught tube, so utilizing the fall of the water to improve the vacuum, for the action of gravity dispenses with a part of the steam velocity otherwise necessary to overcome atmospheric resistance.

## Something About Compressed Air.

BY FRANK RICHARDS.

The use of compressed air for the various purposes to which it has been applied seems to be rapidly on the increase, and the field of its application widens continually. It is used largely for the transmission of power to places or to distances where the use of steam is not practicable. It is used for operating special machinery or for operating machinery under special conditions, and for many purposes where no intervention of machinery occurs, as in the direct transmission of goods by the pneumatic dispatch, the sustaining of earthwork in tunneling and submarine processes, in ventilating and refrigerating, in transferring liquids by its pressure and performing all the functions of the pump for liquids, in aerating oil for combustion, etc. One or two of the large companies building rock drills and mining machinery, and who build air compressors for operating their machines find that part of their business outgrowing all the rest.

The designing and construction and operation of air compressors cannot fail to be of interest to the mechanical engineer. While the compression of air is apparently a simple enough operation, there are questions and difficulties that arise in connection with it that are sufficiently complex to tax the powers of the ablest. Few are familiar with

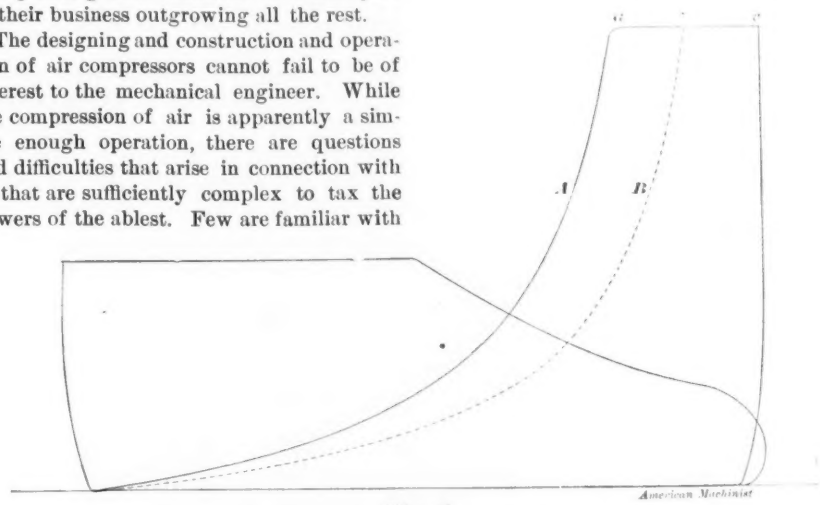



*Fig. 1*

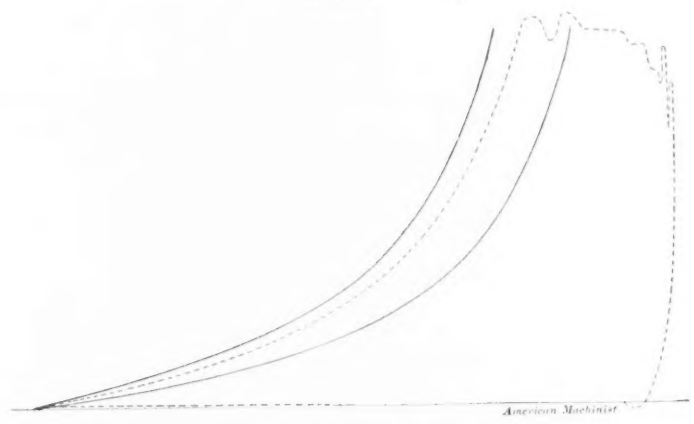



*Fig. 2*

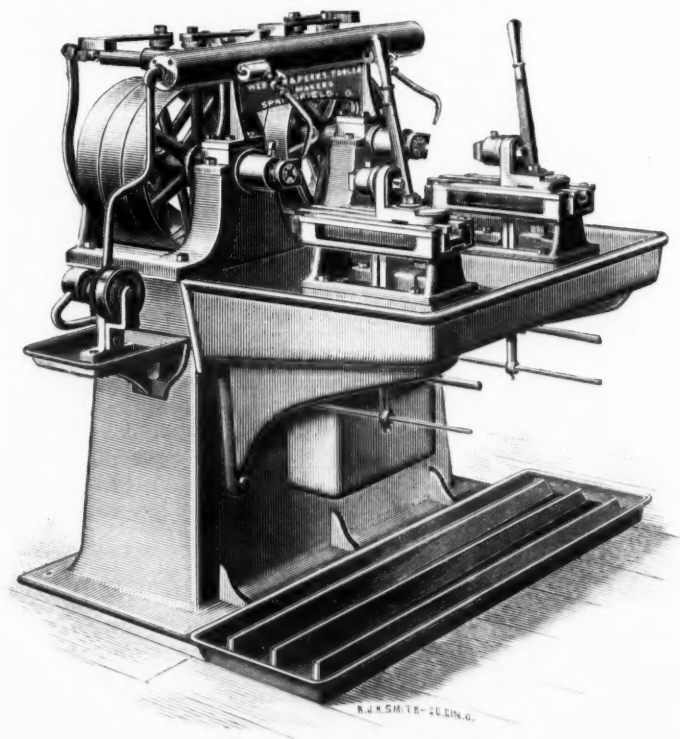
COMPRESSED AIR DIAGRAMS.

the requirements of the problem. Of the peculiar conditions to be met and satisfied in the air compressor, the general engineering and mechanical community are still so uninformed that I remember that it was not so very long ago that it came as a surprise to many if not most of the readers of the AMERICAN MACHINIST that an air compressor with steam and air cylinders of equal bore and stroke could compress air from an atmosphere up to double the gauge pressure of the steam that was operating it. Fig. 1 shows how this can be possible. This diagram, by the way, is not to be attacked with instruments of scientific precision, and is only to be looked at with the naked eye. Here we have steam at say 60 pounds gauge and ¼ cut-off, compressing air to 120 pounds gauge. The relative advantage that the steam has in this respect is greater the higher the pressures are carried. Thus steam at 100 pounds gauge and ¼ cut-off will theoretically compress air to 200 pounds gauge, while steam at 50 pounds gauge will require to follow .6 of the stroke to give it the same advantage in compressing air to 100 pounds gauge.

The advantage which the steam has over the air in the operation of compression is still greater than this. The statements above are upon the assumption that the line *A* is the compression line of the air under consideration, that is, that the air is not cooled by any means during the compression. If the compression line could be the dotted line *B* instead of the line *A*, that is, if the air could be kept at its original temperature throughout the operation, it is evident that the amount of power required would be much less than if the line *A* were followed. As a matter of fact, both the lines *A* and *B* are theoretical lines. It is scarcely possible to compress air so that it will not lose some of the heat of compression during the operation, and the actual compression must of necessity fall somewhere inside the line *A*. So, on the other hand, it is impossible with any compressor yet devised to maintain the air at constant temperature during compression. The temperature of delivery must be above the temperature of admission, and the compression line must be outside or above the line *B*.

It is to be remembered that whether line *A* or line *B* is followed in compression, the same available volume of air is realized in either case, and this volume is represented by the length of the line *b c*, for though the air leaves the compressor at a higher temperature than that at which it enters, it parts with its heat so easily that, if it is transmitted some distance, or if it is retained in a receiver for a short time, it surely drops to the temperature of its surroundings. The loss of power in air compression, then, is in the fact that we compress a volume *a c*, and we realize a volume *b c*. It would seem that we pay for more than we get.

I am able to offer in Fig. 2 an actual indicator card—and I think it in most respects an excellent one—from a water-jacketed air cylinder 16¼″x18″ at 80 revolutions. Scale 40. Receiver pressure about 78. The only means of cooling the air employed was a water jacket entirely surrounding the cylinder, and also a little more than a half of each head.




TWO SPINDLE BOLT CUTTER.

## Two-spindle Solid Die Bolt Cutter.

We present with this an illustration of a two-spindle bolt cutter, using a solid die which is comparatively light and small, very easily and quickly replaced or changed from one size to another, and, being solid, requires no adjustment nor trial cuts, and keeps sharp longer than any die which can yield somewhat to the strain of the cut.

The facility of changing from one size to another is indicated by the fact that all the change required from the smallest and shortest bolt to the longest and largest one is made in about one minute's time. The spindle upon which the change is to be made is the only one that need be stopped. Either one of the spindles may be used for special or other tapping, and the machine is arranged for the convenient fitting and use of special tapping fixtures where the nature of the work to be done requires them. In tapping, the spindles always reverse within one-quarter revolution. Countershaft, oil pump, oil pans, strainers, and all appurtenances required for immediate operation are furnished with the machine.

A special point claimed for this machine is its rapidity of operation, its capacity being quite remarkable. It is made by the Webster & Perks Tool Co., Springfield, O.

## Trial of the U. S. S. "Bancroft."

Special interest attaches to the trial of the "Bancroft," because it is the first case in which the speed was determined by the method proposed by Engineer-in-Chief Melville, and unanimously approved by the Board on Construction of the Navy Department. This method has already been described in the *Journal* of the Society of Naval Engineers (Vol. II., page 73). Briefly stated, it consists in standardizing the screws by a series of progressive trials over the measured mile so as to determine accurately the correspondence of speed and revolutions. (The mean of the revolutions of the two shafts is used.) A curve is constructed exhibiting the relation, and the vessel is then taken to sea for a straightaway run of four hours. During this run the revolutions, as shown by the engine counters, are recorded every fifteen minutes. At the end of the four hours the total number of revolutions made by each engine is determined, the mean taken and divided by 240, thus giving the average revolutions per minute. By applying this to the curve of speed and revolutions the speed is at once determined.

In the contracts for these speed trials there is a provision for premiums and penalties, amounting in some cases to $2,000 for each hundredth of a knot. It follows, therefore, that in using this method some means,

more accurate than the ordinary engine counter, had to be provided for determining the time and revolutions on the measured mile. This led to the construction of the Weaver recording apparatus, which is a specially designed chronograph and revolution recorder. It is described in the Naval Engineers' *Journal* (Vol. III., page 86). This enables the time to be determined to hundredths of a second and the revolutions to hundredths.

Since the "Bancroft's" trial articles in the press have appeared intimating that it was an error to attribute the method to Commodore Melville, and claiming that the same method had already been used, notably in the trials of the "Cushing." These statements disclose a misapprehension of Commodore Melville's plan which it may be well to dissipate.

It would be hard for any one, nowadays, to claim originality for determining the speed of a vessel by the revolutions of the propellers, as this has been done for years, and is, in fact, the method of dead reckoning employed in many steamers. It is, however, only an approximation, although, when done carefully, a close one. It is also true that the "Cushing's" speed was determined by first standardizing the screw on the measured mile, although it is not known whether this was the first case or not. In her case, however, the standardization was to determine the number of revolutions required to give the contract speed, and, so long as this number was maintained on the contract trial, nothing more was required. There was no speed premium or penalty, and it was not necessary to determine the exact speed so long as the contract speed was maintained.

The vital point in Commodore Melville's method, and the only one for which originality can be claimed, is that it makes provision for determining exactly what the speed on the contract trial is to the hundredth of a knot. This it does by combining the progressive measured mile trials with the record of revolutions, both of which, of course, are entirely familiar.

It is apparent that there is no difficulty if the contract speed is less than the highest obtained on the progressive trials, but it might be thought that no provision has been made for the possibility of exceeding this highest previously-determined speed. This point, however, was anticipated and is provided for. To any one who is familiar with the method of laying out these curves of performance, it is well known that the natural position taken by the "spline" or batten in laying out the curve at the highest observed point is identical for a reasonable distance with the curve that would be drawn if a higher point had been observed. Consequently, in laying down the curve of speed and revolutions, it is prolonged by following the natural position of the spline or batten for about a knot, so that, if the contract revolutions exceed those obtained on the measured mile, the exact speed can still be accurately and exactly determined from the curve.

Just here it may be well to call attention to several points in which this method is superior to other accurate methods of determining the speed.

First, is its convenience. No more observers are required than if an ordinary set of progressive trials were to be made, and no course has to be laid off, as the accurate measured mile with ample depth of water has existed at Newport since 1889. When the "Philadelphia" was tried a forty-mile course had to be laid off, and half a dozen ships were stationed along it to secure current observations, while a pilot ship had to precede her on the course to see that the vessels were at their stations and that the course was clear.

Second—The result of the trial is known within ten minutes of its termination, and there are no corrections or changes to be made. A long course trial involves the correction for current, which of necessity must be made afterwards, and may involve considerable delay.

Third—The speed can be determined at any time by simply counting the revolutions, so that the contractors know exactly where they stand.

Fourth—The record of the counters every fifteen minutes enables the contractors to extend the trial, and then take any continuous four-hour period, in case it is found that the performance improves as the trial proceeds. This is impossible on a long course, where it would be necessary to run over the entire course again.

TABLE I.

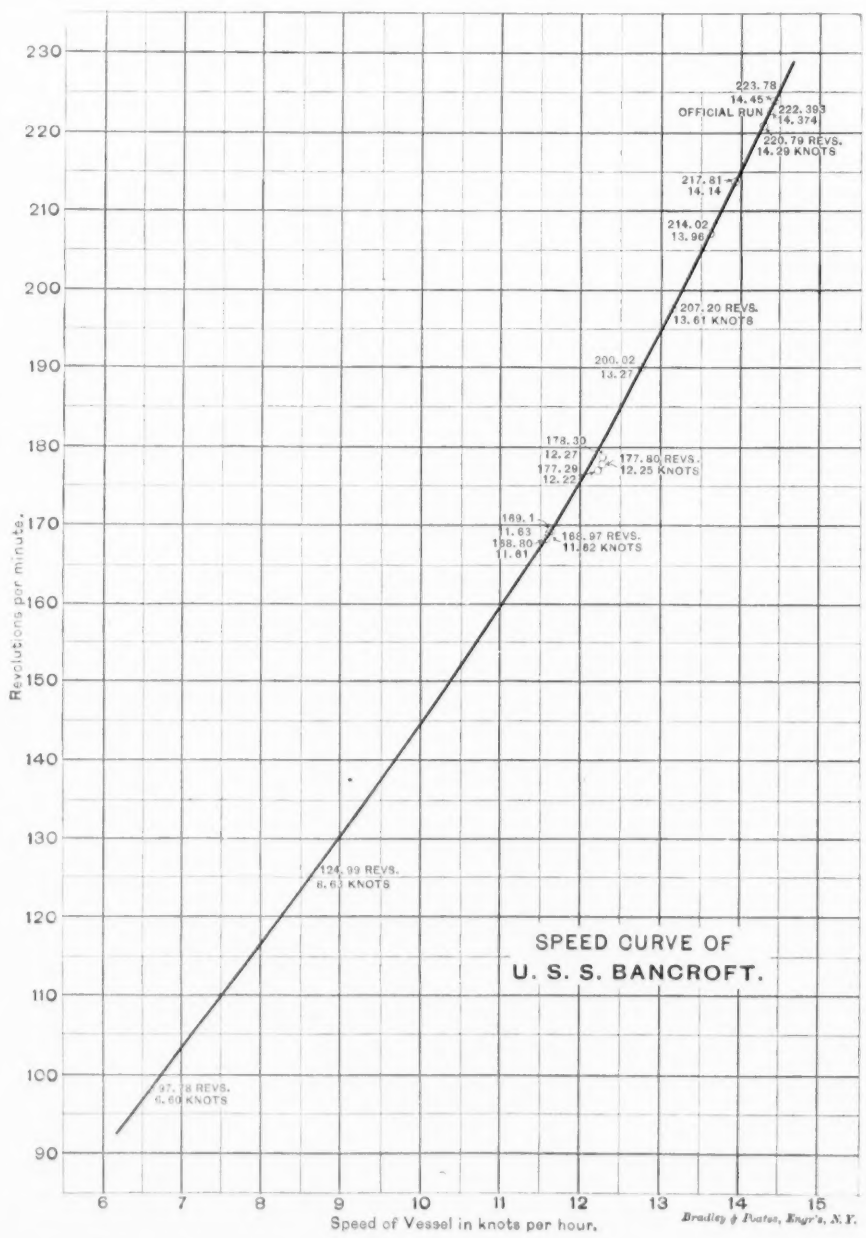
RECORD ON MEASURED MILE BY WEAVER APPARATUS.

| Number of Run. | Time on the Mile. | Revolutions on the Mile. Stbd. | Port. | Mean of Both Shafts. | Revs. Per Min. (Mean of Both Shafts). | Mean Speed, Knots. | Second Means. Speed, Knots. | Revolutions Per Minute. |
|---|---|---|---|---|---|---|---|---|
| | Min. Sec's | | | | | | | |
| 1 Up | 10 13.69 | 1006.24 | 1050.62 | ..... | ..... | ..... | ..... | ..... |
| 1 Down | 7 56.90 | 767.86 | 769.94 | ..... | ..... | ..... | ..... | ..... |
| 1 Mean | 9 05.30 | 887.06 | 859.29 | 888.67 | 97.78 | 6.60 | 6.60 | 97.78 |
| 2 Up | 7 12.23 | 905.32 | 885.90 | ..... | ..... | ..... | ..... | ..... |
| 2 Down | 6 41.59 | 852.79 | 829.87 | ..... | ..... | ..... | ..... | ..... |
| 2 Mean | 6 56.91 | 879.06 | 857.89 | 868.47 | 124.99 | 8.63 | 8.63 | 124.99 |
| 3 Up | 5 14.17 | 873.84 | 877.56 | ..... | ..... | ..... | ..... | ..... |
| 3 Down | 5 05.88 | 857.26 | 879.96 | ..... | ..... | ..... | ..... | ..... |
| 3 Mean | 5 10.02 | 865.55 | 878.76 | 872.16 | 168.80 | 11.61 | | ..... |
| 4 Up | 5 10.92 | 863.25 | 871.63 | ..... | ..... | ..... | 11.62 | 168.97 |
| 4 Down | 5 07.88 | 872.15 | 882.23 | ..... | ..... | ..... | | ..... |
| 4 Mean | 5 09.40 | 867.70 | 876.93 | 872.32 | 169.15 | 11.63 | | ..... |
| 5 Down | 5 02.95 | 900.08 | 886.99 | ..... | ..... | ..... | ..... | ..... |
| 5 Up | 4 46.36 | 847.54 | 848.25 | ..... | ..... | ..... | ..... | ..... |
| 5 Mean | 4 54.66 | 873.81 | 867.62 | 870.72 | 177.29 | 12.22 | | ..... |
| 6 Down | 5 03.91 | 898.92 | 897.85 | ..... | ..... | ..... | 12.25 | 177.80 |
| 6 Up | 4 42.85 | 845.81 | 844.92 | ..... | ..... | ..... | | ..... |
| 6 Mean | 4 53.38 | 872.37 | 871.39 | 871.88 | 178.30 | 12.27 | | ..... |
| 7 Down | 4 35.03 | 927.53 | 928.40 | ..... | ..... | ..... | ..... | ..... |
| 7 Up | 4 27.68 | 882.92 | 879.46 | ..... | ..... | ..... | ..... | ..... |
| 7 Mean | 4 31.35 | 905.22 | 903.93 | 904.57 | 200.02 | 13.27 | | ..... |
| 8 Down | 4 30.99 | 932.64 | 929.93 | ..... | ..... | ..... | 13.61 | 207.02 |
| 8 Up | 4 14.84 | 910.73 | 906.62 | ..... | ..... | ..... | | ..... |
| 8 Mean | 4 17.91 | 921.69 | 918.28 | 919.98 | 214.02 | 13.96 | | ..... |
| 9 Down | 4 12.33 | 916.22 | 928.12 | ..... | ..... | ..... | ..... | ..... |
| 9 Up | 4 16.90 | 926.54 | 936.25 | ..... | ..... | ..... | ..... | ..... |
| 9 Mean | 4 14.61 | 921.38 | 927.19 | 924.28 | 217.81 | 14.14 | | ..... |
| 10 Down | 4 05.76 | 912.90 | 912.64 | ..... | ..... | ..... | 14.29 | 220.79 |
| 10 Up | 4 12.66 | 946.47 | 945.41 | ..... | ..... | ..... | | ..... |
| 10 Mean | 4 09.21 | 929.69 | 929.02 | 929.36 | 223.78 | 14.45 | | ..... |

Fifth—Fog need not interfere with the trial in the slightest degree if it is not made on a frequented course. The only observations for speed are made on the engine counters, and these are not affected. A fog of any intensity would prevent a long course trial.

Sixth—Although not of any bearing on the contract trial, it is an additional advantage that the standardized screw method gives the data of accurate progressive trials, thereby putting the designers in possession of data of the greatest value for subsequent designs.

Seventh—The speed and revolution curve will be of great assistance to the navigating officers in the subsequent regular cruising in furnishing the means of accurately determining the dead reckoning instead of having to depend on the erratic patent log.




The "Bancroft's" progressive trials were made over the measured mile at Newport on January 21st and 23d, consisting of two runs (one each way) at 7 and 9 knots, and four (two each way) at 11.6, 12.25, 13.6, and 14.3 knots. The data for these runs are given in the accompanying table:

From these data the curve of speed and revolutions was plotted on a large scale which would enable hundredths of a knot to be measured accurately. This curve, on a reduced scale, is annexed.

The contract trial was made on January 26th, and consisted of a four-hours' straightaway run almost south from Beaver Tail Light. As already stated the mean speed was 14.374 knots, corresponding to a mean number of revolutions of 222.393.

The following table gives the average revolutions per minute for each fifteen-minute period:

TABLE II.

REVOLUTIONS FOR FIFTEEN-MINUTE PERIODS ON FOUR-HOUR OFFICIAL TRIAL.

| Hour. | Average Revolutions Per Minute for the Fifteen Minutes Ending at This Time. Stbd. | Port. | Mean. | Remarks. |
|---|---|---|---|---|
| A. M. | | | | Counter readings at 8:45 A. M.: stbd., 224,809; port, 224,156. |
| 8:45 | 228.066 | 225.00 | 226.53 | |
| 9:00 | 226.60 | 224.80 | 225.70 | |
| :15 | 224.33 | 226.33 | 225.33 | |
| :30 | 223.27 | 224.07 | 223.67 | |
| :45 | 220.13 | 222.27 | 221.20 | |
| 10:00 | 224.20 | 223.00 | 223.60 | Counter readings at 12:45 P. M.: stbd. 278,355; port, 277,362. |
| :15 | 222.47 | 221.93 | 222.20 | |
| :20 | 222.06 | 222.13 | 222.09 | |
| :45 | 221.93 | 221.33 | 221.63 | |
| 11:00 | 219.60 | 219.67 | 219.63 | Total revolutions in four hours. Stbd. ..... 53548 Port ..... 53826 |
| :15 | 224.20 | 221.07 | 222.62 | |
| :30 | 225.27 | 219.80 | 222.53 | Mean..... 53374.5 |
| :45 | 225.30 | 220.80 | 223.05 | |
| P. M. | | | | Average revolutions per minute for the trial, $\frac{53374.5}{240} = 222.393$. |
| 12 00 | 225.07 | 221.27 | 223.17 | |
| :15 | 221.27 | 218.67 | 219.97 | |
| :30 | 221.70 | 219.67 | 220.68 | |
| :45 | 222.14 | 220.27 | 221.20 | |
| Means | 223.09 | 221.69 | 222.392 | |

During the contract trial two patent taffrail logs were used, each with 400 feet of line. Both were new, but the one referred to as *B* in the following table had been used on the trip of the "Bancroft" from the contractors' works at Elizabethport, N. J., to Newport. It had underlogged the vessel as shown by comparison with bearings. These logs were not tested on the measured mile, but on the way out of Narragansett Bay, before the contract trial, their readings were taken for a distance known by bearings to be about two knots. On this distance log A was correct while log B was 0.2 knot short.

The readings for the four-hour trial were as follows:

| | Log A. | Log. B. |
|---|---|---|
| 1st hour | 14.7 | 13.5 |
| 2d " | 14.7 | 13.6 |
| 3d " | 14.6 | 13.5 |
| 4th " | 14.7 | 13.5 |
| Mean | 14.675 | 13.525 |

The trial was a marked success in every way. The steam pressure and revolutions were maintained with marked uniformity, and the machinery gave entire satisfaction, not a drop of water being used on any of the bearings. There was scarcely any vibration, a glass of water, evenly full, standing on the cabin deck without spilling.

The water at the bow rose about a foot with a flat top and no spray. At the stern there was very little disturbance.

The speed called for in the contract was twelve knots, the boilers being worked under an air-pressure of one-half inch of water.

In explanation of the remarkable excess shown on the trial above the contract requirements it may be said that when the "Bancroft" was designed, it was expected that the air pressure would be about an inch as in the case of the "Yorktown," and all the details of the design were based on this. After the design had been made the air pressure was reduced, and it became necessary to fix upon a new contract speed. As no data were available of accurate trials with half an inch air pressure, an estimate was based on the "Yorktown's" performance with an inch. It was supposed that about twelve knots and a half could be obtained if everything worked perfectly, and, in accordance with the department's practice of allowing a slight margin for unforeseen contingencies, twelve knots was fixed as the contact speed.

The "Bancroft" has a remarkably fine hull, the lines being the design, it is understood, of the late Naval Constructor Gatewood. This accounts for a part of the superiority over the "Yorktown's" record. In addition the contractors used special ma-

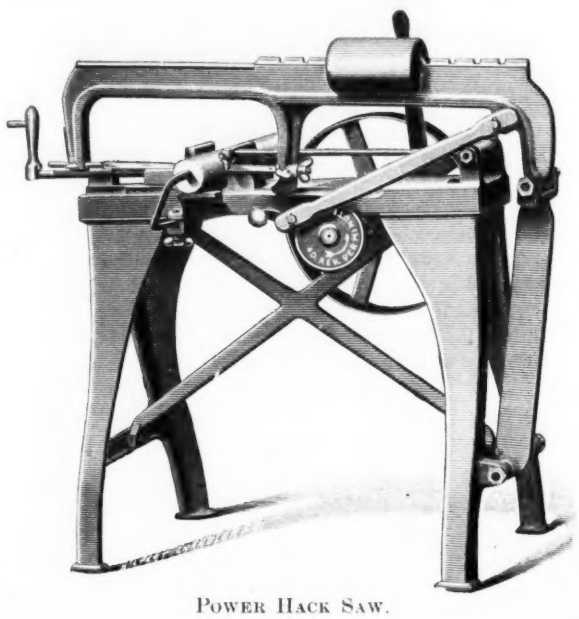
chinery with which they have been building high-speed stationary engines for making all working parts absolutely true, the piston and valve rods and shafting being all "ground true." Selected Pocahontas coal was also used, while the "Yorktown" had anthracite. Finally the "Bancroft's" engines are vertical, while those of the "Yorktown" were horizontal.

The splendid performance of the machinery and the marked success of the trial reflect the highest credit on the builders, the Samuel L. Moore & Sons Co., of Elizabethport, New Jersey.

### "Stover" Power Hack Saw.

We present herewith an illustration of a power hack saw in which the relative position of the crank wheel and the point of connection to the moving frame is such that on the forward stroke of the saw the pressure is much increased and almost entirely relieved on the back stroke, the total pressure being adjustable by moving the weight from notch to notch on the frame.

When the piece is cut off the blade is automatically lifted and the machine stops. It cuts a bar of any shape up to 4½ inches in size, and requires no attention except to put in and adjust the bar against the stop. It is made by the Stover Novelty Works, Freeport, Ill.



POWER HACK SAW.

## LETTERS FROM PRACTICAL MEN.

### Hardening and Tempering Small Work.

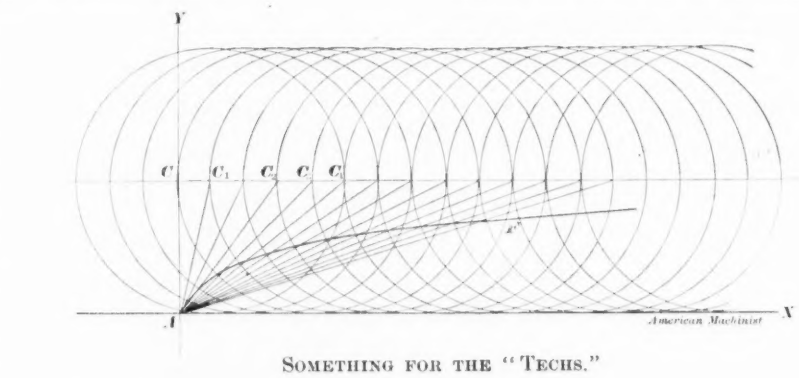
*Editor American Machinist:*

There are a great many things in the toolmaker's art that may be reduced to a science; for to make a good tool is an art, and requires considerable science. I think there is nothing in connection with making fine tools more important than hardening and tempering them, and to do this scientifically one must have scientific appliances, and the smaller the article to be hardened the more care is required to get good results, in some cases. In any case, in treating cast-steel the best appliances obtainable are necessary to get both speed and quality. The country is full of shops where a mechanic cannot heat a piece of steel that weighs more than a couple of ounces without going to the blacksmith with it, and wasting his own time and the blacksmith's, too, in waiting for the work to be done. He generally has to wait his turn, or the blacksmith's convenience, or build a fire in a separate forge. In any case it is an infernal nuisance to a fellow who has an ambition to do his work quick as well as right, and one is as important as the other in determining the value of a man to his employer.

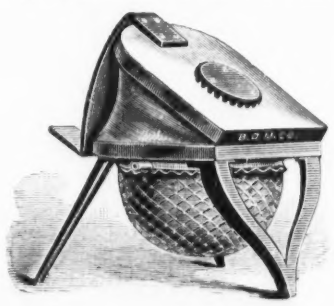
Now for heating small articles, say from ⅝" section by say 4" long down to the smallest piece, I have never found anything so useful, cheap and satisfactory as a good pair of foot bellows, a pressure blow-pipe, such as is used by dentists for making plates, melting gold, etc., and a rectangular sheet-iron box 8" long by 3x3", one end hollowed out to within an inch of bottom, a sheet-iron hood the whole length of the box and curved to deflect the heat toward the bottom, leaving a full length opening between hood and top of opposite side of box, and the bottom covered an inch or so thick with asbestos; this device is shown by the sketch, while the wood cut gives a view of the foot bellows I use and which is made by the Buffalo Dental Manufacturing Company of Buffalo, N. Y.

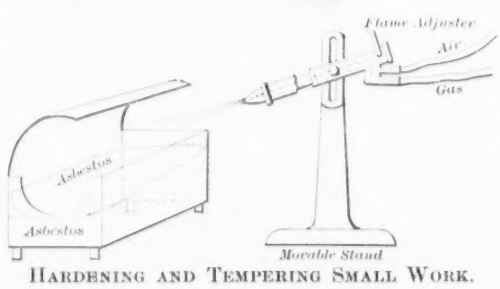
With this appliance you have the heat completely under control, the air pressure by foot and gas pressure by hand, they can be mixed in any proportion at will, and nothing but satisfactory results can follow the use of the apparatus I have described. If its real merits were only known to the foremen of tool rooms, it would have a universal application, as the forge or furnace is not in it for small taps, dies, reamers, drills, and the thousand and one things that are being hardened constantly in tool rooms. For drawing temper there is nothing that will approach the alcohol flame for small work; it does not discolor a polished piece of steel when applied to flame direct, and for a single piece this is very quick and handy. For several pieces, place in a thin copper pan with turned-up edges and handle for removing all quickly. The heat draws more evenly and uniformly than with anything else I have ever seen or used. The pan should be used as a cover for sheet metal box, the right height above flame, the lamp inside, and lower part of two sides of box cut away, V-shape, to admit air.

Chicago. H. HARDINGE.




SOMETHING FOR THE "TECHS."






HARDENING AND TEMPERING SMALL WORK.

### The Foundry Accident.

*Editor American Machinist:*

A word in regard to unusual foundry experience in your issue of February 9, 1893.

I have had something of the same experience, and I find by investigation it has been due to several causes.

1st. The cupola was not dry, perhaps.

2d. The pig and scrap-iron were wet with snow and ice.

3d. The atmosphere being damp and heavy would cause the gas to escape out of the tapping hole and around the bottom of the cupola, there being so much wet iron in the cupola that the steam forced the gas down and out through the tapping hole.

I have never seen this happen only, as I say, when the iron was wet and the atmosphere close and heavy.

To prevent this, I, on such occasions, charge a little early and give the steam time to work off some before I put on the blast.

It is best to open up *all* ventilators as soon as you put on the blast, as cold air is more healthy than gas.

Hoping this will help on the good cause, I remain,

B. F. CHAMBERS,
Foreman Buda Foundry Co.
Harvey, Ill.

### Something for the "Techs."

*Editor American Machinist:*

The *Youth's Companion* has recently printed a story describing the adventures of two graduates of a technical school in China. The story purports to be written by one of the "*Techs*" to whom these adventures befell, and as the author of the story is my authority for using the very convenient abbreviation given in the title, I am thus led to the conclusion that it has become current, and that no apology will be demanded of me for adopting it.

I judge that the AMERICAN MACHINIST must be a rather favorite publication with the "*techs*," as I have never been in any technical school whose library does not contain it, and where it does not appear to be in great request. Being also acquainted with many graduates of technical schools, I do not now recollect any one of them who does not regularly read it. For this reason I am led to suppose that something especially directed to them, provided it require but little space in presenting it, and is likely to interest them, might be acceptable to the editors of so progressive a paper, particularly as I suppose there must always be much in such a paper that, though unadapted to some readers, may be highly interesting to others.

In the course of my regular work I had to draw a rather peculiar curve, for which I worked out the equation referred to, its vertex and axes. The accompanying diagram shows the form of the curve and a method of constructing it by points.

Let $A\ Y$ and $A\ X$ be the axes of a system of rectangular co-ordinates, the point $A$ being at the vertex of the curve.

Let $C$ be the center of a circle located in the axis $A\ Y$, and let this circle be rolled along the axis $A\ X$, in such manner that the center occupies successively different positions $C_1$, $C_2$, $C_3$, etc. The positions of the center so indicated are shown as equi-distant from each other, but this is merely for convenience in drawing. The character of the curve will not be changed by any irregularity in these distances.

From the several successive positions occupied by the center of the generating circle, respectively, draw the lines $C_1\ A$, $C_2\ A$, $C_3\ A$, etc., and trace the curve $A\ F$ through the points of intersection of these lines with the circumference of the generating circle.

What are the elements of this curve? To what class of curves, if any, does it belong? Has it a focus or foci? Has it a center according to the general definition of center as applied to the parabola and other curves? What is the simplest equation for the curve, and what are the equations for the normal, sub-normal, tangent and sub-tangent? Has the curve an asymptote, and, if so, how is this line located with reference to the curve? All these questions suggested themselves to me, and were sufficiently interesting to lead me into an investigation. If the curve is to be found in any treatise on analytical geometry I should like to be informed where it can be found. LEICESTER ALLEN.

### Forgings from Sibley College.

*Editor American Machinist:*

I was much interested in what Dr. Thurston said in your last issue about forgings at Sibley College, and also your remarks relative to them, more especially because my own teaching has brought me to like observations and thoughts with those of Dr. Thurston.

I gladly second all the Doctor has said, and even at that do not consider the subject exhausted. When it becomes generally known that boys often go from these practical schools with months instead of years of experience, and take positions of journeymen workmen, we would naturally admit that the "school shop" is a good place for an apprentice, not that the subsequent shop experience will add nothing of value, but that the start in the school is the very best sort of start, and will do immensely more for the boy hour for hour, the first few months, than can possibly be done in an ordinary shop, the advance being very largely in the direction of skill as well as system, and principles upon which the correct action of tools is based.

But I am inclined to think your criticism, or rather that of the practical machinist, a little too severe on the Doctor.

It seems never to have entered the head of the critic that the professional tool dresser can possibly turn out faulty work. How about the practice of the tool dresser who likes to take it easy, and to this end heats his tool steel just a little too hot for its subsequent good cutting qualities, for the sake of easy forging, and gives the machinist a burnt tool? Also who hardens two or three times as far back from the point as needed, and draws temper too low at half inch from point, while still the point is too hard, giving the result that the tool is nine-tenths of the time too hard or too soft; and at the same time the steel at the cutting edge hardened and rehardened so many times by reason of plunging too deep at each hardening on redressing, till the steel at the point has been rehardened a half dozen times?

Any one who does not believe that a steel tool does not yield about 10 per cent. of its fine cutting virtue at each rehardening, ought to redress stone drills and use them for awhile, when it will be found that it pays to cut off from the end of the tool, and throw away all steel that was previously hardened.

How many of the tool dressers aim to make the shape of the tool so as to require a minimum of grinding, at first and all the time, so as to diminish the danger of "burning" on the emery wheel?

That the Sibley College tools exhibited were temper colored after grinding is no proof that in the college practice this is done as a rule. Sometimes things are done for the good appearance of an exhibited article that would not be done as a common practice, as in the case of several lathe tools I have in my university cabinet here on exhibition as examples of such tools as made by some of our leading manufacturers. Most of these tools are ground to shape, and temper-colored, too. In each of these tools there is no telling what shape the forger left the points in, and these very tools have the fault mentioned for the Sibley College tools—of too much "inclination forward," and I would not wonder if they were worse.

As to the cutting qualities of the Sibley College tools, why not put them to the test before implying that they are fire-worn by excessive reheatings?

In this connection I would suggest an interesting test, viz.: Procure a bar of tool-steel, cut off two tool blanks, send one piece to Sibley College for dressing and tempering, and the other to the professional tool dresser. Then place both in the hands of some one good machinist to use and report on.

Perhaps you will pardon me for here correcting a wrong impression given in a former issue of the American Machinist, containing an abstract of a paper read to the Mechanical Engineering Teachers' Association, to the effect that I have no use for a college shop, or workshop in a college graduating mechanical engineers.

My aim in the original paper was at the *name*, and not the school shop itself. I would have the mechanical laboratory, elementary and advanced, the former on tools and hand craft, and the latter on experimentation and testing of various kinds.

Why not call a chemical laboratory a medicine shop or factory, or a metallurgical laboratory a furnace or foundry? Likewise, why call a mechanical laboratory a shop? The shop is for making or repairing of articles for money compensation, while the so-called school shop, or more properly, laboratory, is for educational purposes.

I have no use for the *name* "school shop" or "shop work in school," or "college workshop," etc., but have the highest respect for and ample use for the mechanical laboratory, both elementary and advanced.

S. W. Robinson.

### Those Sibley College Tools.

*Editor American Machinist:*

I note what your, and our, friend says about the tools sent you, as made by a young man—having had no previous experience—after the equivalent of twenty days' work under systematic instruction. It is true, as he remarks, "the proof of tools is in the using of them, and when these are tried in use they might not prove of much value," notwithstanding the fact that they "look well" and appear to be a "good set of tools."

Now, if you will hand them to some one who is a judge, and is accustomed to use tools of these sorts on such work as they were intended for, and who will conscienciously make the trial, and return them, with report, at an early date, I shall be glad to know what is the verdict, and will then, perhaps, have a few words to say about the points which have been raised. When a boy in a short jacket, I thought I knew something about machine tools, and was accustomed to handle all kinds and for all purposes; but a man grows more distrustful of his own omniscience as his beard begins to gray, and I shall listen with due respect to all suggestions and opinions. When the evidence is all in and in type, I shall be glad to close the case with a few remarks that may remove some misapprehensions, and may possibly show that the progress of the world during the generation is not entirely lost sight of.

Those tools were made for use, and are expected to do as good work as any tools to be found, on ordinarily light engine, or fairly heavy tool construction. We build nothing larger, however, than a 14-inch lathe, in the latter direction, and have only built up to 35 horse-power, in the former, though we have a large and handsome Worthington duplex feed-pump on the floor just finished, and the shafts, rods, and cylinder castings of a 150 horse-power triple-expansion engine on hand in various stages of completion. I shall be glad to show these samples of the work done by the makers of such tools as those sent you, *and with such tools*, to any one who desires to know what quality of work is done by them. My own impression is that these specimens will do us no discredit with any competent mechanic.

When your batch of tools has been tried, I will gladly give an outline of the process of making them, and the reasons for the method.

R. H. Thurston.

### Cylindrical vs. Conical Cam Rollers.

*Editor American Machinist:*

I admit the correction of my assertion that conical cam rollers are ever right in cylindrical cams, and am glad that Mr. Robinson sets me right. This makes the true theory correspond with my long experience with conical rollers, which experience proves them to be inferior to cylindrical ones.

It is obvious if the cheeks of a cam groove were flattened to an exact plane, and the surface so produced should be an exact annular section, that is, an incomplete and perfectly regular flat ring, that a suitable conical roller could move upon it without any friction due to sliding. No cam groove, except that impractical one described by Mr. Robinson, seems to fill this requirement, and unless this requirement be filled a conical cam roller is not theoretically right.

A. D. Pentz.

### Standard Keys.

*Editor American Machinist:*

I have read with much interest in the American Machinist several articles relating to the adoption of a system of standard keys.

I believe that $\frac{1}{4}$" taper in 12" would in a great measure overcome the difficulty mentioned in Mr. Pryibil's letter in your issue of Feb. 5th, wherein he says he has been compelled to break the pulley and split the hub to get them off, by reason of rust having formed on the key. I have used the $\frac{3}{16}$" taper per foot, and found the same trouble in getting keys out of pulleys and gears, as mentioned by Mr. Pryibil. Have found in my practice that keys having $\frac{1}{4}$" taper per foot hold equally as well as those having $\frac{3}{16}$" taper; do not give as much trouble when taking them out, and require no more time in fitting them than those of $\frac{3}{16}$" taper. I fear it will prove a difficult matter to harmonize the conflicting opinions which will be urged for and against the standard taper, width and thickness, as builders of machinery have their own standards established, and do not find it profitable to change from what they term good enough. The most feasible plan I can think of would be to continue to agitate this question until it attracts the attention of some enterprising individuals who will engage in the manufacture of keys as a specialty, they profiting from ideas given by various contributors, establish therefrom a standard, and sell the keys to manufacturers for less money than their previous cost when they made them. By that means persons having a key list may cut their splines and seats in accordance with standard given therein.

| Shaft Diameter. | Width. | Thickness at small end. |
|---|---|---|
| $1\frac{3}{16}$ inch. | $\frac{5}{16}$ inch. | $\frac{5}{32}$ inch. |
| $1\frac{7}{16}$ " | $\frac{3}{8}$ " | $\frac{3}{16}$ " |
| $1\frac{11}{16}$ " | $\frac{7}{16}$ " | $\frac{7}{32}$ " |
| $1\frac{15}{16}$ " | $\frac{1}{2}$ " | $\frac{1}{4}$ " |
| $2\frac{3}{16}$ " | $\frac{9}{16}$ " | $\frac{9}{32}$ " |
| $2\frac{7}{16}$ " | $\frac{5}{8}$ " | $\frac{5}{16}$ " |
| $2\frac{11}{16}$ " | $\frac{11}{16}$ " | $\frac{11}{32}$ " |
| $2\frac{15}{16}$ " | $\frac{3}{4}$ " | $\frac{3}{8}$ " |
| $3\frac{3}{16}$ " | $\frac{13}{16}$ " | $\frac{13}{32}$ " |
| $3\frac{7}{16}$ " | $\frac{7}{8}$ " | $\frac{7}{16}$ " |
| $3\frac{11}{16}$ " | $\frac{15}{16}$ " | $\frac{15}{32}$ " |
| $3\frac{15}{16}$ " | 1 " | $\frac{1}{2}$ " |
| $4\frac{3}{16}$ " | $1\frac{1}{16}$ " | $\frac{17}{32}$ " |
| $4\frac{7}{16}$ " | $1\frac{1}{8}$ " | $\frac{9}{16}$ " |
| $4\frac{11}{16}$ " | $1\frac{1}{4}$ " | $\frac{5}{8}$ " |
| $5\frac{3}{16}$ " | $1\frac{5}{16}$ " | $\frac{11}{16}$ " |
| $5\frac{7}{16}$ " | $1\frac{3}{8}$ " | $\frac{3}{4}$ " |
| 6 " | $1\frac{7}{16}$ " | |

¼ inch taper per foot.

I give table for keys; also sketch of sheet steel depth gauge for key seats, which I used successfully for eleven years, while in charge of the City Mill Works.

Peter Shellenback.

### Filing Clippings—Arrangement of Technical Journals.

*Editor American Machinist:*

I was interested in the letter from O. A. Smith in your issue of February 16th regarding the best method of preserving valuable articles which appear in the technical journals. I think with him that a good method is to clip the articles and place them on file.

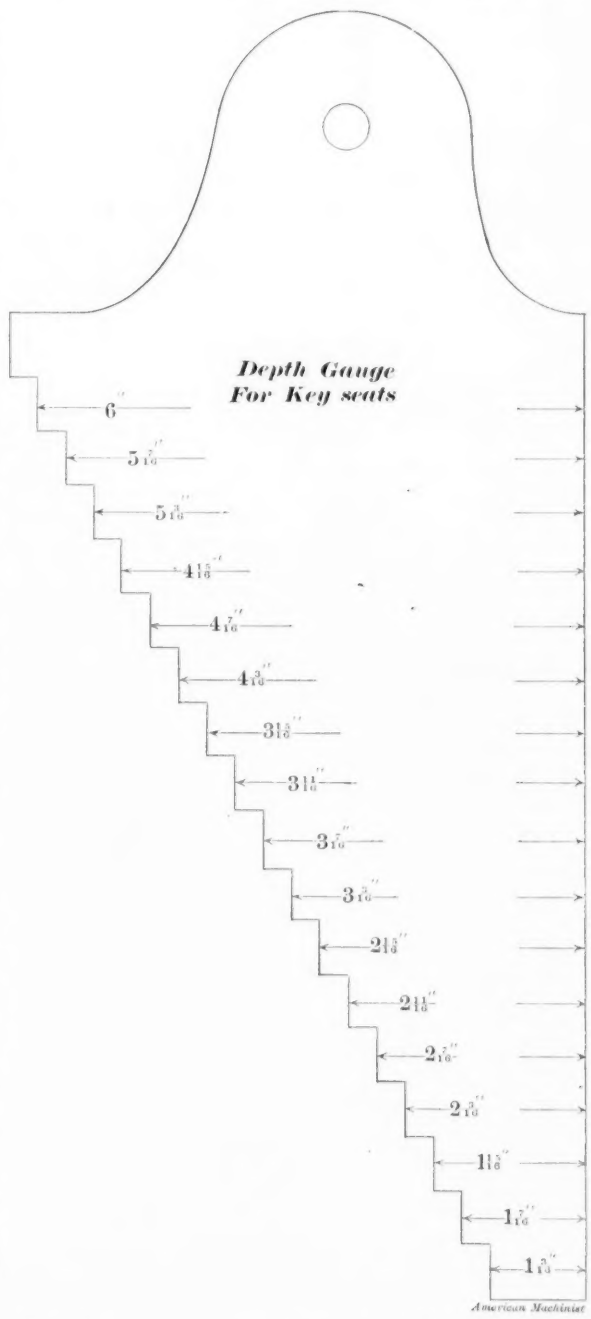
With the usual arrangement of reading matter, clipping one article will mutilate another which may prove later to be of equal or greater value than the one preserved. This difficulty could be obviated by printing reading matter and advertisements upon alternate pages. With this arrangement, after clipping the most valuable articles, the remainder of the paper would be uninjured and could be filed as before for future reference. Advertisers would also probably appreciate the advantage of having their advertisements placed before each reader without either intruding upon him or requiring him to turn of his own accord to the advertising pages. If one had, side by side, the articles upon the best methods of working steel which have been contributed to the American Machinist by skilled workmen during the last two years, he might be able, from this more or less contradictory testimony, to arrive at conclusions nearer the truth than any one of the contributors would be able to state. I should be pleased especially to see this arrangement adopted in the American Machinist and in *Power*, because I value the contents of these papers most highly.

Edwin C. Knapp.

### Engineers and Machinists in the Navy.

*Editor American Machinist:*

I have read with much interest the editorial review in your issue of the 16th inst. of a letter published recently in the *New*




*York Times* by a correspondent who calls himself "Fair Play," and who has for some weeks past been devoting his time to attacking, through the medium of that newspaper, the opinions of the Engineer-in-Chief of the Navy as expressed in his last annual report, the merits of a bill now before Congress, intended to increase the efficiency of the naval engineer corps, and the duties and status of the engineer officers generally.

In order to understand this controversy, it is necessary to know something about the condition of the navy, present and past, as regards its engineering branch.

Since the invention of the steam engine, it has been viewed with disfavor by a conservative element of society, which always arrays itself against every new thing, and clings to that which is old, even if the old thing is a lumbering stage coach, and the new thing an express locomotive. Nowhere more than in navies, and in no navy more than in our own, has this anti-progressive spirit flourished. Since the first engine, and the first engineer went on board an American man-of-war, the line officers (those whose business it was to handle ships under sail) have missed no opportunity to belittle the innovation and its attendants, and to place every obstacle possible in the way of their development. Although charged with the performance of duties fully as important as they saw being done around them by line officers, the engineers had to struggle for years before they were recognized as having an official status, and that recognition, although provided for by law, is even now accorded with very bad grace by many of the quarter-deck officers.

Now that steam has completely displaced sails as the motive power for war vessels, one would think that the importance of the engineer officers should increase, while that of the sailor officers should decrease, such a change being logical and in accordance with plain common sense, and has, moreover, taken place in the merchant marine to a large extent. In the navy, however, it has thus far been prevented by the opposition of the line officers, who are powerful in numbers and from long existence, and who see also that the admission of the fact that engineers have responsible duties would result in the public discovery that their own special duties have disappeared. Hence it is that the line of the navy is banded together in an effort to keep the engineers out of sight, and to magnify their own antiquated duties, and that some young line officer like "Fair Play," occasionally rushes into print to attack the advance of modern progress—to play the part of the young and inexperienced bull who sought to stop the locomotive.

The paucity of numbers in the engineer corps, which corps has been steadily decreasing ever since 1882, when the rebuilding of the navy was begun, and the inferior status accorded engineers in the navy led to the introduction of a bill in Congress about three years ago, the bill being intended to remedy existing grievances, and was approved by the Secretary of the Navy. Of course this bill was opposed by the line officers, and the letter of "Fair Play" in the *Times* is a fair sample of the nature of the opposition.

After drawing a number of comparisons with the navies of foreign countries, all of which have systems of conscription, and in every case giving incorrect figures as to the number of engine room officers, the *Times*' correspondent proceeds to sum up his statement of the case in the language which you quote, and which purports to show that the bill is simply intended to oppress and keep down the machinists in the navy. There is nothing whatever to justify such conclusion, and to people familiar with the navy it is extremely funny to see a line officer posing as the champion of the machinists, or of any other part of the engineers' force, seeking to defend them against the engineers.

My own observation during many years of sea service in the navy is that the enlisted men of the engineers' force—machinists and all—are treated with kindness and consideration by the officers of their own branch, so long as their conduct and performance of duty entitles them to such treatment, and that their treatment at the hands of the line officers on deck is that accorded to a "pariah

class," and is precisely as described so directly by the Engineer-in-Chief on page 36 of his last annual report. No one more than the present Engineer-in-Chief has sought to improve the condition of the machinists and other enlisted men of the engineer department, as is shown by his recommendations on the subject for the past several years, and no one more than he has had the courage to say very plain truths in a very plain manner about this same subject. The fact that he has done so accounts for the desperate attempts of such persons as "Fair Play" to get space in the public prints to discredit his facts by garbling or misquoting them. So long as the engineers and their men will uncomplainingly bear their grievances, it is said that the navy is "efficient," but when suffering in silence ceases to be a virtue, and an outcry is made against unreasonable abuses, then we begin to read letters in the daily papers about the navy and its awful condition, as compared with the monarchical naval organizations of European countries..

After having spent a cruise in driving machinists down below the fire-room gratings when they venture that far towards the sacred precincts of the "deck" to get a breath of fresh air, Mr. "Fair Play" now chooses himself their champion, because by so doing he sees a possibility of being believed in his senseless arguments, and thus causing one class of engineers to become hostile to another class. Surely no man, be he engineer or machinist, who is intelligent enough to buy and read the AMERICAN MACHINIST, is going to be deceived by the blandishments of any such wolf in the clothing of a sheep.

In regard to the allegation that only practical engine drivers should run marine engines, and allow such of them as are willing to do it to fit themselves for designers by application and study, I would suggest that a good part of such study be done at the proper time, viz., in the school-boy period, thus making the young engineer better qualified to benefit by his practical experience. It is a manifest truth that no man is fit to design marine machinery unless he has had experience in managing such machinery at sea, and it is by combining the practical and the designing engineer that the United States and England have avoided many of the mechanical puzzles and impossibilities that have been placed in vessels of other nations by artistic draftsmen. I have myself seen a "marine engineer," who had never been to sea, design a boiler with a manhole against a permanent bulkhead, and another one so locate a large vertical engine that its cylinder head could be raised less than three inches for purposes of examination; both of these mistakes cost money to rectify, and neither would have occurred had the designer ever seen a man get into a manhole or look into a cylinder.

The practice in the American navy of giving its young engineers a good grounding in the theory as well as the practice of mechanical engineering, sending them to sea for several years, and then allowing them to alternate sea duty and designing, is a good one, and gives them the opportunity to remedy in new designs the defects that have vexed them at sea. At any rate the greater part of all the designing of machinery for the new navy has been done by exactly this kind of men, and no one can deny that the performance of our new vessels is a source of national pride when compared with the trial trips we read about in some of the foreign navies. NAVAL ENGINEER.

### Cleaning Boiler Tubes—American Locomotives.

*Editor American Machinist:*

One of my firemen had the tubes in two vertical boilers to clean recently, and thought that a jointed rod and one other arrangement we had were too cumbersome, slow, and involved too much hard work, so he fastened a weight to one end of the scraper and a rope to the other, got a box to sit on, fixed a pulley overhead so that it could be moved to four different positions, took a seat and inserted the weighted scraper into a tube and down it went, taking soot and scale in much better shape than the slower way. By the aid of the rope and pulley it was quickly raised to the top again and the operation repeated until all were cleaned.

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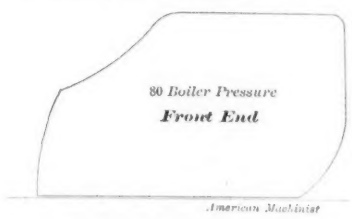
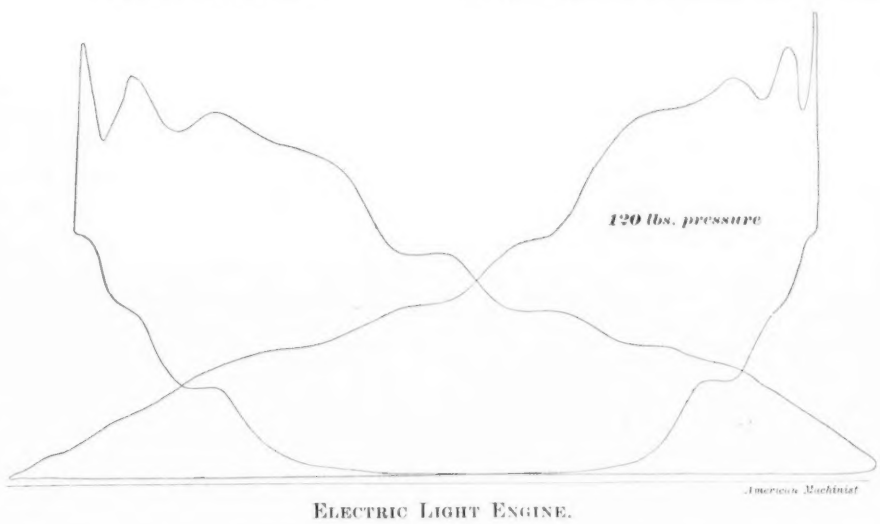
In the AMERICAN MACHINIST of December 22d Mr. Booth fears that the talk on locomotives is partisan rather than mechanical.

Mr. Booth commenced by suggesting that the American locomotive builder was away behind the times in not having seen the utility of the fire brick arch.

It was not the writer's intention to attempt any defense of the American locomotive, but to show that it needed no defense, so I remarked that this arch was in use before my experience on railroads, and I find on further inquiry that the N. Y. & N. H. R. R. has had them in use for about twenty-seven years, or almost from their first using coal, and that the N. Y. C. R. R. had used them for some years previously.




PORTER LOCOMOTIVE.




ELECTRIC LIGHT ENGINE.

Mr. Booth also remarked that the American locomotive was a dirty looking machine and would not be tolerated at any station in Britain.

The American might chop part of his cab off, take off his bell and headlight, put his sand-box down among the machinery, cover the whole over with sheet-iron and paint it, and he would have a simpler and neater looking engine, but it would not run any faster, nor haul any larger trains, and certainly the engine could not be kept as clean and in as good repair as cheaply as now.

Mr. Booth was also of the opinion that the small coupled wheels could not make any kind of fast time, while the P. & R. R. R. over a year ago broke the world's record by running several consecutive miles at the rate of 90 miles per hour, with one of a class of engines having 68" wheels. This has been repeated so much that it is nothing novel now.

Mr. Booth mentions the P. R. R. as building larger wheels. This road is one of our large systems, is well-managed, safe—when the block system works—but it does not make the fastest time. It is a better road, and makes faster time than it would were it not for those two thorns in its flesh, the B. & O. and the P. & R.

In the near future it will make the distance of 90 miles between New York and Philadelphia in 90 minutes, not because it wants to do it, but because these two roads will compel it to do it.

It is becoming the custom to put on lighter trains of four cars and run them faster. It may be possible to use a larger wheel on these light trains.

A large wheel of course means less power and less shaking up of the locomotive and longer life to the road-bed. A rival of the big wheel is looming up and may do away with it. This is the electric motor, which will do away with the thrashing of the reciprocating motion of the steam locomotive, and give the continuous rotary motion so much desired. The greatest objection to it is the enormous first cost, being for the engine, boilers, dynamo, motor, etc., something like $80,000 to take the place of a $10,000 locomotive. When, however, it can do the work with half the fuel, and the fuel used being of a much cheaper grade, and the wear on track and rolling stock so much lessened, it may prove to be not a bad investment.

Mr. Booth appears to be troubled with back pressure, and I regret that I am not now in a position to give diagrams that the case requires. The trouble with the link motion is the excessive compression and lead rather than the back pressure. I send in this a card taken from a Porter switching locomotive.

This card was taken at about 150 revolutions per minute. I am sorry that I have not a track of sufficient length so that I can get a card at 300 revolutions, as it is apparent that it would not be seriously distorted, nor be troubled much with back pressure. The second card is from an engine running electric lights and making 315 revolutions, and the back pressure is no more than in many engines with 100 revolutions.

Mr. Booth gives tracings of what he says are two of the most successful locomotives in that country, and the indicated power as nearly 1,100. As I understand it the "Empire State" has indicated 1,300. If I am mistaken will some one please correct me? This train has only four cars, while many have from seven to ten His locomotive might keep them going after they were started, but it would be so long getting started that it would be of little use on these roads that are being rebuilt, and so many stops, many of them at the foot of grades.

I hope Mr. Booth will not get discouraged, as I think you, Mr. Editor, and your readers that are interested in railroads will agree with the writer that he has given us some mighty interesting reading. I regret that I have not the time and access to reliable data, so that he might in some way feel repaid, as I think he is giving more than value received. W. E. CRANE.

### The Milling Machine Again.

*Editor American Machinist:*

A few years ago, when I was writing the series of articles on the milling machine, its construction and uses, for the AMERICAN MACHINIST, I was frequently called the milling crank by those who knew but little about the milling machine and its value as a labor-saving tool. The paper on the milling machine as a labor-saving tool in machine construction, read by me before the American Society of Mechanical Engineers, caused considerable discussion, and many were the letters I received from owners and managers of shops throughout the country. That I was partly right, at least in my assertions, has been fully demonstrated by the large increase in the number of milling machines in use at the present time. One large manufacturer writes me that his sales had doubled, he giving me credit for a large amount of the increase as coming from reading the above-named articles in your valuable paper. In the columns of the AMERICAN MACHINIST and other mechanical papers there has been, in the past six or seven years, illustrated and described many and various forms and adaptations of the milling machine, some of them good, some bad, and others indifferent. As the milling machine is being improved in its construction, and designers are awakening to the fact that this class of machinery needs great strength and rigidity and massiveness of certain parts to prevent vibration, various kinds of work that have been attempted and dropped as impracticable, owing to the spring and chattering, have been again picked up, and made not only practicable, but commercially successful. The full amount of work the milling machine is capable of doing will never be obtained until the cutters are ground on the arbor, and while in the spindle of the machine. Every workman conversant with the milling machine knows that a perfectly true cutter—and now and then such a one is to be found—will stand a feed of three or four times that which can be put on a cutter running badly out of truth. The reason for this is obvious; each tooth does its proportionate amount of work, while a badly running cutter cuts but on one side, and often on only one or two teeth. More work is being done on the vertical type of milling machine than formerly, and several excellent machines of this kind have recently been brought out. A large amount of circular work is being done with milling cutters, such as turning gear blanks and sheave pulleys, and at a cost of say a quarter the price of turning in a lathe. I do not doubt that at no very distant date all locomotive and steel-tired car wheels will be turned in this manner, and it is easy to see the saving in cost when turned in this way. It always does a man good to see what he has foretold come to pass; all or even more has been done than I expected in many kinds of work, and I can truly say that there are some things now being done on the milling machine that I am not astonished at; yet, if I had ever hinted at them as to come, I would have been called crazy instead of a crank. I had intended before this to publish a book on the milling machine, but owing to my time being fully occupied, have not been able to do so. We may soon look for a book of this kind from the pen of one far more able to do the subject justice than I, and who has made it a study for several years, and for the past year or more devoted his whole time to gathering information from the principal makers and users, and not omitting some of the small shops where he found many little tricks and traps of ingenious design and construction not found in many of the larger and more pretentious ones. JOHN J. GRANT.

### Pure Emery.

*Editor American Machinist:*

In February 23 issue of AMERICAN MACHINIST I notice Mr. W. H. Booth inquires for some coarsely ground *pure emery*, stating: "Probably *all* who use emery know that it is largely adulterated with iron." I would like to inform him that there *is no* iron used by emery manufacturers to adulterate emery; in fact, emery is composed of silicate of aluminum, sapphire or ruby and iron fused by volcanic action. *Pure emery* is at least 40 per cent. iron; still you will not find any free iron; the crystals are permeated with it, and it can only be separated by assaying.

If he will obtain some corundum, he will get the nearest to what he is after.

GEO. A. WALKER.

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The coast defence ship, the Indiana, recently launched from the Cramp's shipyard, is in every way a formidable vessel. She is 348 feet long on load line, 69¼ feet breadth of beam, with a draught of 24 feet, and a displacement of 10,200 tons; horse-power, 9,000, and guaranteed speed 15 knots. Her heaviest armor plates are 18 inches in thickness, and largest guns 13 inches. Her keel was laid in May, 1891. She will be completed in about one year.

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## Railroad Corporations and the People.

The citizens of Jersey City are bringing a strong pressure to bear in the direction of compelling the Erie Railroad Company to elevate its tracks in that city. Instead of dealing in generalities they have obtained and published the number of people killed at the various grade crossings of this road in the city from 1885 to 1891. At one crossing twelve were killed and many more injured during the period covered as above; at each of two other crossings eight were killed. At other crossings several lives have been lost. As an answer to the railroad officials declaration that elevating their tracks is an engineering impossibility, the citizens have obtained the opinions of engineers to the effect that there are no difficulties worth mentioning in the way.

The soullessness of corporations, so much talked about, is very well illustrated by the willingness of railroad companies to continue indefinitely to kill and maim people when a comparatively small expenditure would prevent it. A man, otherwise irreproachable, will be a party to such killing and maiming, apparently quieting his conscience by reasoning that he is no more to blame than others. This may be one of the besetting sins with which all men are confronted, but it seems to get a stronger hold on railroad officials than it does on men engaged in other affairs of life.

It is seldom that any reform in railroad operating looking to the safety of the public is adopted by railroad corporations except through the concerted action of the public, which results, or which it is foreseen will result, in legislation compelling such reform. The abolishment of grade crossings, the heating of passenger cars and the block system, are amongst the instances going to substantiate this. Considerations of humanity—so it appears to outsiders—have no weight in the matter.

But when the people become shocked into moving—really a matter of self-protection—then the railway officials and the stockholders lose no time in raising the cry of "persecution." No doubt laws have sometimes been enacted that were hardly just to some railway corporations. When the public finds that it is necessary to fight in order to protect itself in every matter of property and safety in which these corporations are concerned, it is in the condition of the individual who is forced to fight in self-defense, and who very naturally uses such weapons as are at hand, not only with a view to protecting himself, but to injuring his assailant.

Railroad corporations have been dealt very generously with in this country. No one finds fault with this; but when this generous dealing inflates them with the idea that they own the earth, and can maintain as many death traps as they choose, block up thoroughfares at their will, and otherwise conduct their business to the detriment of everything else, it is time for the people to move. The citizens of Jersey City are to be commended for the stand they have taken, and for the sensible and thorough manner in which they have gone about their work. Their plan of procedure is worthy of being copied by other cities.

## The Title of Engineer.

We think some misapprehension has arisen regarding the discussion which took place at the fall meeting of the American Society of Mechanical Engineers regarding the use of the title "Engineer." There are those who seem to think that the "Engineers," (*i. e.*, the Mechanical Engineers), at that meeting objected particularly to bearing the same title borne by "engineers" (*i. e.*, stationary engineers), or "engineers" (*i. e.*, locomotive engineers), or "engineers" (*i. e.*, engineers employed in paper mills), because these latter wear overalls and sometimes have soiled hands. We do not understand that this fairly represents the spirit in which the discussion was carried on.

A member of the society had proposed as a topic for discussion the advisability of an attempt to revise the right to the use of the title of "Engineer," by which he meant mechanical, mining and civil engineers, etc. Other members in discussing this question thought that one of the first things to be done was to remove, if possible, the confusion attending the use of the title at present, owing to the fact that men pursuing very different occupations were all known by the same title. This confusion does exist and is often confusing and misleading, as we very well know, entirely independent of the question of overalls or gloves, or in which article of apparel the greater credit and honor lies. One, at least, of the members who discussed the subject, distinctly disavowed meaning any disrespect to overalls or greasy hands, and said he had worn overalls and had his hands and face as black as anybody else ever had, and was not in the least ashamed of it.

That there are members of the A. S. M. E. who would be ashamed of wearing overalls and of having greasy hands, and who take special pains not to be confounded with men who indulge in these, is very possible, but that any such sentiment prevails in the society is by no means true.

The only objection to the present use of the term was based upon the confusion attending its use, a confusion which is sometimes quite annoying, because misleading and liable to lead to mistakes and misunderstandings. It is objectionable for much the same reason that the confusion in wire gauges is objectionable. A number of a wire gauge has not a sufficiently definite meaning, and it is the same with the term "engineer."

## The Alleged Conspiracy.

We are by no means convinced that there has been an intention to deal unfairly in the matter of the assignment of space to exhibitors at the World's Fair; but if we had become convinced that there had been questionable practices indulged in, and were asked to name what we considered the strongest evidence of it, we should not quote anything from the critics of the exposition officers but their own charge that New York manufacturers have a conspiracy against the fair.

No charge has been brought against the exposition management which seems to us to be half so damaging as this boomerang, which virtually charges New York manufacturers and business men with being such fools as to be willing and anxious to injure themselves commercially from spitefulness and simply because the fair was given to Chicago instead of to New York. When the Chicago people understand the matter somewhat better than now, they will appreciate the fact that the New York man who will sacrifice the least commercial advantage on account of any supposed slight put upon his city would be a very great rarity, and that a conspiracy among New York manufacturers and business men to injure themselves in order to spite a rival city is inconceivable by any one who knows much of New York.

There must be a much better defense than this against the charges of unfairness upon the part of the World's Fair officials, which have been made by the eastern piano makers and others, and we think it is time to bring forward such a defense, because the countercharge of conspiracy is worse than none.

It is always a little more than difficult to get at exact figures in such cases, but it is quite evident that the City of Paris beat the Teutonic, in the recent voyage of these two vessels from Queenstown to Fire Island, by something like two hours—more or less.

The two vessels left Queenstown within about one hour of each other. The fact that these two great ships, both built for speed, should run so close in the long voyage shows—along with similar examples—the degree of perfection to which the building of such ships has been brought, as well as the skill with which they are managed. The closeness of the run puts the two vessels practically on a level as to speed, but as before this is read the City of Paris will have become the Paris of the American line, Americans are glad that she was ahead.

## Literary Notes.

PUMPING MACHINERY. A Practical Hand-book relating to the Construction and Management of Steam and Power Pumping Machines. By William M. Barr, Member American Society Mechanical Engineers.

We believe it is safe to say that there is scarcely a subject in regard to which technical literature is so meager and unsatisfactory as that of pumping machinery, and therefore a work of this character by an author who has had a wide range of experience in the construction and management of steam pumps, and whose reputation for thoroughness and reliability is established by his previous works treating on the Combustion of Coal and Steam Boilers, will supply information which cannot be found in any other book.

The character of this work is essentially descriptive of pump detail, and treats on water pistons and plungers, piston and plunger rods, water valves and seats, air and vacuum chambers, suction and delivery pipes, water end design, hydraulic pressure pumps, steam and power crank pumps, direct-acting steam pumps, the duplex pump, compound direct-acting steam pumps, fire pumps, mining pumps, rotary pumps, centrifugal pumps, duty-trials of pumping engines, high-duty pumping engines—direct-acting, and high-duty pumping engines—fly wheels.

The book being largely descriptive, its illustrations have been made a prominent feature, as the author regards a single suggestive sketch of more real value than a page of reading matter. With few exceptions, the illustrations, two hundred and seventy in number, are from pumping machinery actually constructed and in use, and a large proportion of the whole has been transferred directly from his own practice. One hundred and ninety of the cuts were made from drawings expressly executed for this work.

The merit of the book lies chiefly in the judicious selection and arrangement of its contents rather than upon strict originality, the independent manner in which the author expresses his views, and the care and labor involved in gathering reliable data, so as to place the book among the standards in technical literature.

Engineers, architects, contractors, plumbers, and all those in any way interested in pumping machinery, or those who have occasion to recommend or use these, and also those who wish to inform themselves regarding pump construction, will find this book an extremely valuable one; and the information it conveys can be accepted with confidence. We do not know of any book that we can recommend more highly than this one.

It is published by the author, William M. Barr, 3223 Powelton avenue, Philadelphia, Pa. Price $5.

ENGINE-ROOM CHAT. By Robert Grimshaw, M. E., Past President James Watt Association, No 7, of New York, N. A. S. E.; Member Fulton Council, No. 1, A. O. S. E; Mech. Editor Power and Transmission.

In this little book of 144 pages the author presents ideas, in a desultory manner, principally relating to the occupation of those who are in charge of engines and boilers and their appurtenances. The practical engineer and those interested in the generation of power will find in these pages many hints which may be of value to them in their daily routine of work, although in some paragraphs much that is of value is hid by the superfluous so-called chat, that it may try the patience of a certain class of readers to find it. In our opinion the presentation of subjects could be much condensed with profit to all concerned.

The author's ideas of rivet holes we believe to be erroneous; on page 71 he states: "My ideas have undergone a change on the subject of making rivet holes. I used to think that punched holes in iron plates were weaker than those which were drilled. I now find that they are really a trifle stronger, if they have been properly punched. The reason is that there is a sort of flow of metal around the punch. When it starts in through the plate it makes a

slight depression in it before any metal appears on the other side; then when the plug falls out it will be found of less density than the plate from which it was punched. Some of the metal has been forced from before the punch into the walls of the hole, making a kind of bushing of compressed iron which renders that hole less liable to tear when shearing strain is placed upon it than if it had never been so reinforced."

Now compare the above with a statement found in Elements of Machine Design, by Prof. W. C. Unwin, which is as follows: "A number of experiments show a loss of tenacity after punching, varying from 5 per cent. up to 20 per cent. in iron plates. It is diminished by making the hole in the die-block one fourth greater in diameter than the punch; and the loss completely disappears, and the tenacity is restored, if the plate is annealed after punching; or if a small ring, .04 to .08 inch in thickness, is rymered out of the punched hole. There can be no doubt that, in punching, a portion of metal is squeezed laterally into the plate, and a condition of permanent stress is induced in the metal immediately surrounding the hole. It is this which is got rid of by annealing or rymering." The book is published by the Practical Publishing Co., 21 Park Row, New York. Price $1.

## QUESTIONS AND ANSWERS.

*Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.*

(101) J. T., Augusta, Ga., writes: Kindly inform me if there is a machine built for grinding the sides of razors hollow? *A.*—We do not know of any special machine built for the purpose.

(102) C. F. D., Peoria, Ill., writes: Please state why a compound engine should have a cut-off valve on the low-pressure cylinder? *A.*—The cut-off valve on the low-pressure cylinder is generally used for adjusting and equalizing the work performed by the steam in the high and low-pressure cylinder.

(103) B. A. C., Petoskey, Mich., writes: I have an eight horse-power upright engine; its governor is on the dance all the time. The engine has no counterbalance, and its fly is small. Please advise me what to do to make the governor run steady. *A.*—It is possible that the cause of your trouble is in the construction of the governor, which may be too sensitive, but from meager data you have given us we should judge that the fly-wheel is too light; therefore increase its weight, and counterbalance the reciprocating parts of the engine.

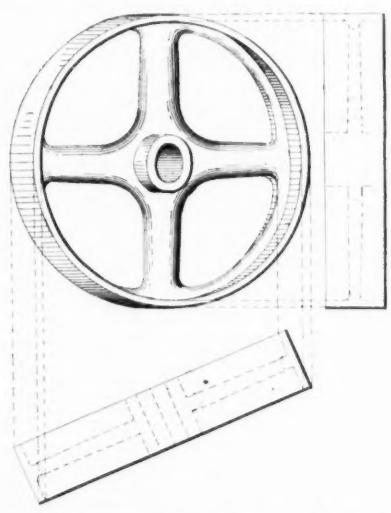
(104) Reader, Lowell, Mass., writes: Kindly inform me in regard to the following matter. I am a machinist with over ten years' shop experience, and the last two years I have been employed as stationary engineer and am quite familiar with the steam engine. I understand perfectly well geometry and algebra. Do you believe that by studying books treating on the steam engine I could prepare myself to pass an examination for an engineer's license? If so what books should I study? *A.*—With the experience you have had, and by studying books relating to steam engineering you should have no difficulty in passing a creditable examination. J. Bourne's catechism of the steam engine, and A. Jamieson's text-book on steam and steam engines are good books. It is advisable to get both.

(105) A. M. A., Kearny, N. J., writes: Please give the most practical construction of a piston for an air compressor, one that will give the least amount of friction. The diameter of the pump cylinder is 4 inches; stroke, 4 inches. The present piston is made of cast-iron, with two cast-iron rings for packing. *A.*—Leather packing can be used in cases where the temperature of the compressed air will not be so high as to injure the packing. When the heat developed during compression becomes excessive metal packing will have to be used. For this we should use two steel rings, cut open and sprung into two annular grooves turned into a solid cast-iron piston. The rings should be about ¼-inch wide and $\frac{3}{16}$-inch thick, accurately fitted into piston and cylinder, with sufficient inherent elasticity to keep them in air-tight contact with the cylinder walls.

(106) G. H. W., New York, writes: Kindly inform me what is the loss through leakage, etc., in feed water per 24 hours for a surface condensing engine. *A.*—Under ordinary circumstances there is practically no loss due to leakage in the condenser, and it may be assumed that the supply of fresh water from the condenser is the same in amount as that evaporated in the boiler. The waste or leakage which must be made good by a supply from other sources is due to blowing some of the water out of the boiler to get rid of scum floating on the surface of the water, blowing of the whistle, or using an auxiliary engine which exhausts into the air. From this it will be seen that the waste depends much on the general arrangement of the plant, and the judgment of the engineer, and that it is impossible to give a definite amount of loss of water applicable to all cases.

(107) E. L. J. & Co., Dover, Del., write: We have several tons of gas retorts we want to melt with other scrap. Before melting they appear soft, but after melting with other iron they make very hard castings. Is there anything in making of coal gas that causes the hardness of the iron? Will old retorts make soft castings by mixing with any brand of pig-iron? *A.*—W. J. Keep, of Detroit, bases his answer to this upon experience gained with the system of tests recently described by him in our columns. His answer is as follows: The iron from gas retorts may have absorbed sulphur from the coal from which gas was made. In any case, by mixing sufficient silvery iron the castings will be gray and soft. Any iron broker will sell Ohio or Southern silvery pig-iron, or there may be a silvery iron made at a nearer point. Add, as a trial, 25 per cent. silvery iron to 75 per cent. gas retorts; if too soft, use less, or *vice versa*.

(108) J. H., Menasha, Wis., writes: Please give me a simple method for making a perspective drawing of a pulley. I have looked over my old papers and books, but am unable to get any information. By answering this question you will oblige an old reader. *A.*—The rules of perspective are



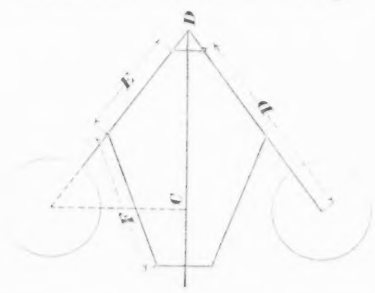
not difficult to understand or to follow, but to one who is not thoroughly familiar with descriptive geometry and its application, it will be a difficult matter to give simple rules. Under these circumstances, the best course to follow will probably be to make an oblique projection of the pulley, as indicated by the accompanying sketch. For this purpose, a knowledge of the principles of mechanical drawing only is required, and these have been plainly stated in the articles on practical drawing, recently concluded in our columns. The principles applicable to this problem will be found in our issues of December 17 and 31, 1887.

(109) Correspondent, Brockville, Canada, asks: Are packing rings used in piston valves, or are they solid and turned to fit the chamber? If packing rings are used please describe them. *A.*—For small engines the piston valves are frequently made without packing rings, an illustration of this kind of valve you will find in our issue of November 24, 1888. In regard to solid piston valves A. E. Seaton, in his Manual of Marine Engineering, states: "Such a form would suit all sizes of engines if always working at full speed; but when standing or running slow the leakage past the valve, when it was worn, would soon be so considerable as to cause serious loss and make the engine very unhandy. To avoid this it is usual to pack the valves much in the way that ordinary pistons are packed, except that the junk rings and flanges are chamfered away, and the packing rings are made to project from them so as to allow free passage to the steam. The spring rings are made of strong cast-iron, or bronze with stiff cast-iron lining rings inside them, and since, owing to the very slight velocity at which the valve moves, the wear is small, the rings should have very little set or spring."

(110) J. S. C. writes: We have experienced considerable trouble from the fire-brick melting in our cupola. Our foundry foreman insists upon mixing the fire clay with salt every time he re-lines it, and it is our belief that this may have something to do with the conversion of the brick into a stringy slag under the intense heat. Is it customary to use salt for this work? *A.*—Mr. Simpson Bolland replies to this as follows: Regarding the use of salt to mix with sand for furnace lining, or with the clay for building purposes in the cupola, I think this bad practice may have originated in a misconception of its right use in the stone and earthenware manufactories, where salt is extensively employed as a glazing agent, its volatility at furnace heat combining with other qualities to fit it for this use. No doubt it has been thought by those who were only partially instructed in these things, that a permanent glaze, similar to that produced on the earthenware, might be given the cupola by the use of salt; but, if they will remember that salt fuses at a red heat, they will at once realize that any salt used for cupola purposes must constitute a slag-forming agent, at every heat, until every vestige of salt has been melted out.

(111) W. S. H., Morgantown, W. Va., writes: Kindly answer the following questions: How can I clean grease and dirt off a belt without injuring it? *A.*—Wash it with soap and water; use a brush. 2. How far in advance of the crank should the eccentric be set? *A.*—For an engine in which the axis of cylinder and center of crank-shaft lie in one straight line, and the eccentric rod is connected directly to the valve stem, the center line of motion of the valve gear being parallel to the axis of cylinder, draw a line perpendicular to the center line of crank, and set the eccentric at a distance equal to the lap and lead ahead of the latter line. If the axis of the cylinder and the center of crank-shaft do not lie in a straight line, cases of this kind frequently occur in locomotive practice, and when rockers are used for connecting the eccentric rod to the valve stem, the above rule will not hold good. If you thoroughly understand the principles of construction of valve gears as stated in the papers relating to modern locomotive construction, recently concluded in our columns, you should be able to set the eccentrics for any ordinary slide valve engine. 3. Give rules for finding the proper length of governor valve stems, and the length of a valve stem when setting a piston valves. *A.*—No rules adaped to all cases can be given, as much depends on the general design of engine.

(112) W. H. W., Petaluma, Cal., writes: I am building a gas engine with cylinder 6 inches diameter, stroke 7 inches, to run about 200 revolutions per minute. The valves are worked by a cam on an upright shaft which will run at the rate of 100 revolutions per minute. On the top of this shaft I want to put an ordinary governor, as per sketch. Now what I want to know is: How heavy should the balls be, and what should be the length of the arms $D$ and the distance $E$? The design of the engine is such as to prevent me from running the governor by a belt or gears without some difficulty. *A.*—The weight of the balls depends on the resistance which they have overcome; of this you have given no data, and therefore we cannot advise you correctly. The distance $C\,D$, that is, the vertical distance between the ball center and the point where its line of suspension cuts the vertical axis, is called the height of the governor. Assuming that the sleeve at the bottom of the links $F$ is without weight, and if there are no resistances to its motion, the height depends absolutely upon the angular velocity of the governor. No matter what the size of the engine or



the weight of the balls may be, such a governor rotating 60 times per minute must have a height neither more nor less than 9.785 inches, and for any other speed the height will vary inversely as the square of the velocity per second. It is obvious that this places a practical limit to the use of such a governor, because at speeds exceeding much the speed of 60 revolutions per minute its height becomes so small as to be constructively very inconvenient. In your case, for instance, and under the above assumed conditions, the governor having to run at a speed of 100 revolutions per minute, or 1.66 per second, could only have a height of $\frac{9.785}{1.66^2} = 3.58$ inches, which would make the arms $D$ about 4 inches long, and these, we believe, will be too short for any practical use. To obtain a greater height $C\,D$ you will have to reduce the speed of the governor, or make the sleeve at the bottom of the link $F$ comparatively heavy. If we make the length of $E$ equal to that of $F$, and denote the length of $E$ by $l_1$, and the length $D$ of the arm of the pendulum by $l$, the weight of one ball by $G$, one-half of the weight of the sleeve by $Q$, the height of the governor by $h$, and the angular velocity per second by $w$, we have

$$w = \sqrt{\frac{32.2}{h}\left(1 + \frac{2\,l_1}{l}\,\frac{Q}{G}\right)}.$$

From this formula $h$ can be found. The smallest angle of inclination between the axis of the governor and arm of pendulum is not usually taken less than 15 to 20 degrees, or greater than 40 to 45 degrees; hence, when $h$ is known, the length of arm is easily determined.

## BUSINESS SPECIALS

*Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.*


Grant's Gear Advertisement is always on page 11.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Ideal Drawing Stands. M. C. Hammett, Troy, N. Y.

Forming Lathes. Mer. Mach Tool Co., Meriden, Ct.

Tool Holder: Armstrong Bros. Tool Co., Chicago.

Norway Rivets, Evans & Robertson, Cincinnati, O.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

Pattern and Brand Letters. A variety of sizes and styles. Heber Wells, 8 Spruce St., New York.

Drill Presses, with Tapping Attachments.
Gould & Eberhardt, Newark, N. J.

Davis Key-Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty St., N. Y.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt St., N. Y.

Pulley lathes, most efficient offered. The Lodge & Shipley Machine Tool Co., Cincinnati, O.

Engine Castings, Humphrey's Foundry, Bellefontaine, O.

For Cypress Tanks and Vats, address W. E. Caldwell Co., Floyd and Main Streets, Louisville, Ky.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

"Shapers (Double Triple Quick Stroke")
Trade Mark.
Gould & Eberhardt Newark, N. J.

For the Latest Improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., corner Canal and Washington Sts., Chicago, Ill.

Combination, duplex and special gear cutters in stock and to order. R. M. Clough, Tolland, Conn.

Gear Cutters, Auto. Specially adapted for Motor Gears and all other style Gears.
Gould & Eberhardt, Newark, N. J.

S. W. Card & Co., Mansfield, Mass., are putting on the market a new line of stocks and dies, with their patent adjustable dies and guide. S. A. Smith, 23 S. Canal Street, Chicago, Ill., Western Agent.

Patent Soliciting of High Class.
D. Walter Brown, Counsel in Patent Cases,
31 Nassau Street, New York.
Send for Brief History of Patent Legislation.

De Lamater Screw Propeller Wheel, made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

"Binders" for the AMERICAN MACHINIST. Two styles—the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUBLISHING CO., 203 Broadway, New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price, $2 postpaid. Published by John Wiley & Sons, 53 East Tenth Street, New York.


### Hydraulic Reaction Motors.

Professor De Volson Wood's paper on the above subject, presented at the last meeting of the A. S. M. E., though too long, and much of it too heavy for reproduction here, contains much of practical value, which, in order to give our readers the advantage of, we present the following abstract:

The paper contains a large amount of analysis. General formulas are deduced, and numerical results obtained for wheels supposed to be of about the proportions found in practice; and the latter are so tabulated as to make them available to the general reader.

Three solutions are made: for a limiting case for a frictionless wheel; a second, for a wheel involving friction, in which the sections of the buckets and guides are determined from the computed velocities; and a third also with friction, in which the forms and dimensions of the buckets are assumed,

but the terminal angle of the guide is computed, so that the steam from the guides to the buckets shall be smooth and without eddies, and the buckets full when the wheel is running at best effect.

It is well known that if the wheel is not running for best effect eddies will be formed, and hence the sections of the live steam will not be coincident with the actual sections of the buckets, and the angles of exit from the guides and of entrance into the wheel will not be the same as those of the wheel, but will be changed to unknown values. It is, therefore, impossible to make an analysis that will be applicable to a wheel running at all velocities. These wheels should be proportioned for and run at a particular velocity; although experiment has shown that this efficiency is not seriously affected if the velocity be somewhat above or below that for which it is designed. The wheels considered in this paper were for inflow and for outflow, in which the larger rims are $\sqrt{2}$ times the inner.

The first case was used to show that the pressure of the water in the wheel does work in the sense that pressure drives a piston in an engine. Water could not do work in passing through a wheel without producing pressure in some direction. If there were no upper crown on the wheel, there would be a pressure against the concave side of the bucket produced by a continual deflection of the steam; and a pressure on the lower crown due to the weight of the water, and no pressure upward, the upper surface being free. Such a wheel is called one of "free deviation." The pressure doing work, above referred to, is equal in all directions in any cross-section of the steam.

Let the terminal element of the guide be tangent to the initial rim of the wheel, and the terminal element of the bucket tangent to the quitting rim of the wheel as in Fig. 1. If the buckets and guides were indefinitely narrow now water would flow in this case, but it is only necessary to conceive that the angles were very small and not absolutely zero in order to realize an actual case. It is then shown that the velocity of the initial rim, for best effect, must be that due to half the head in the supply chamber, and the velocity of the water quitting the guide must be the same. Also the water will leave the wheel without velocity; hence the total head will be effective in doing work. Hence, if $W$ be the weight of water passing through the wheel per second, $H$ its fall, $V$ the velocity of exit from the guide, we have,

$$Work = W H = \tfrac{1}{2}\frac{W}{g}V^2 + \tfrac{1}{2} W H$$
$$= \tfrac{1}{2}\frac{W}{g}.g H + \tfrac{1}{2} W H,$$

in which the last term, $\frac{1}{2} W H$, is the work done by direct pressure; hence, in this case, one-half the work done by the wheel will be due to direct pressure in the wheel, and the remaining half to the energy of the water entering the wheel.

In the next case it was assumed that the terminal angle of the guide was 25°, terminal angle of the bucket 12°, the co-efficient of friction 0.10, the initial angle of the bucket 60°, 90°, 120°, 150°, respectively, and the efficiency determined for best effect, with the following results:

$\alpha = 25°$. $\theta = 12°$. $\mu_1 = \mu_2 = 0.10$.

| Initial Angle $\frac{1}{2}\phi$. | Outflow $r_1 = r_2\sqrt{\frac{1}{2}\phi}$. | | | Inflow $r_1 = \sqrt{2}\, r_2$ | | |
|---|---|---|---|---|---|---|
| | Vel. of Inner Rim $\omega r_2$. | | Efficiency E. | Vel. of Inner Rim $\omega r_2$. | | Efficiency E. |
| 60° | 0.934 | $\sqrt{g H}$ | 0.812 | 0.780 | $\sqrt{8 H}$ | 0.911 |
| 90° | 0.886 | " | 0.827 | 0.689 | " | 0.908 |
| 120° | 0.762 | " | 0.838 | 0.576 | " | 0.898 |
| 150° | 0.366 | " | 0.744 | 0.271 | " | 0.752 |

Fig. 2 illustrates the case in which the initial angle of the bucket is 60°, and Fig. 3 when it is 120°, both being for outflow wheels.

According to the table the velocity of the wheels should decrease as the initial angle of the buckets increases, for best effect. Also the efficiency of the outflow wheel increases as the same angle increases from 60° to 120°; but for the inflow wheel the efficiency is greatest when this angle is 60°, but the decrease is only 1.3 per cent. up to 120°. The efficiency is more nearly uniform for the inflow wheel for various initial angles of the buckets, and generally greater than for outflow. For the outflow wheel the initial angle of the bucket should be more than 90° for best effect.

For the third solution the following results were found:

| Initial Angle of Bucket. | Outflow $r = r_2\sqrt{\frac{1}{2}\phi}$. | | | Inflow $r_1 = \sqrt{2}\, r_2$. | | | Terminal Angle of Guide. |
|---|---|---|---|---|---|---|---|
| | Vel. of Inner Rim $\omega r_2$. | | Efficiency E. | Terminal Angle of Guide | Vel. of Inner Rim $\omega r_2$. | Efficiency E. | |
| 60° | 0.972 | $\sqrt{g H}$ | 0.804 | 31° | 0.709 | $\sqrt{g H}$ | 0.920 | 2° 5′ 4″ |
| 90° | 0.874 | " | 0.828 | 24° | 0.688 | " | 0.920 | |
| 120° | 0.796 | " | 0.839 | 19° | 0.668 | " | 0.919 | |
| 150° | 0.709 | " | 0.921 | 13° | 0.654 | " | 0.918 | 3° |

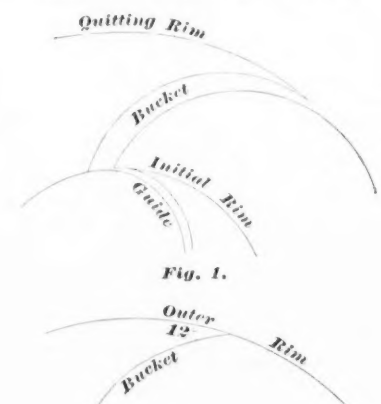



Fig. 1.

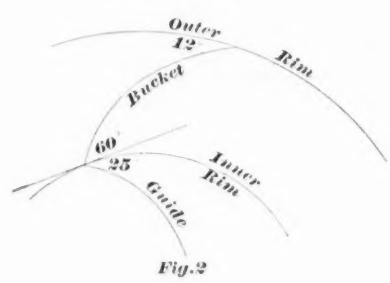



Fig. 2

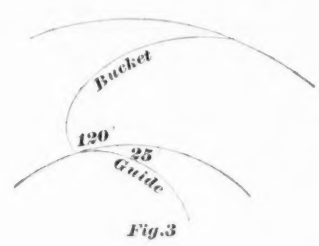



Fig. 3

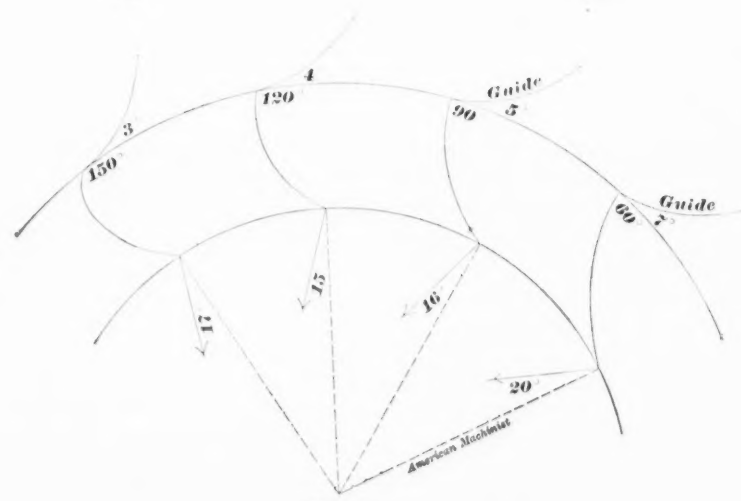



*Fig. 4*

Hydraulic Reaction Motors.

Here it will be seen that the efficiency of the inflow wheel generally exceeds that of the outflow, and since wheels having an initial angle of the bucket of more than 120° are not made in practice, it may be said that in practice the efficiency of the inflow wheel of these dimensions always exceeds those for the outflow when run for best effect.

Also, the efficiency of the inflow is more nearly uniform for the varying conditions here assumed than that of the outflow.

Comparing this table with the preceding, it will be seen that the efficiencies are larger when the terminal angle is properly proportioned, as in the latter table (except for the outflow, when the initial angle is 60°). But for the wheels having 90° and 120° for the initial angle of the buckets for the outflow wheel the efficiencies are practically the same; while for the inflow wheel the increase is only about 2 per cent. It appears, then, that as wheels are ordinarily constructed the terminal angle of the guide for the outflow should be about 25°, and for the inflow about 6° to 10°, and that for some departure from these values the efficiency will not be greatly changed. The character of the workmanship may produce more effect than the particular values of these angles.

The larger the initial angle of the bucket the slower should be the velocity of the wheel for best effect.

The larger this angle the smaller should be the terminal angle of the guide.

For outflow wheel the initial angle of the bucket should exceed 90°, but nothing appears to be gained in making this angle other than 90° for the inflow.

In Fig. 4 is shown the guides and buckets for the four cases for the inflow wheel given in the preceding table.

The arrow lines show the direction of the quitting water. It is thrown forward of the radius at that point, making an angle of about 15° with the radius. In the outflow wheel, when running for best effect, it was found to be thrown backward at quitting, making an angle of about 10° with the radius.

It is well known that the slower the velocity of the wheel the greater must be the depth, or the diameter must be greater to yield a given amount of work. In practice, some efficiency may be sacrificed for commercial considerations; such as size of wheel, facility in construction, etc.

The paper closed with a discussion of the "jet propeller," the chief novelty of which consists in deducing the formulas for it from the general equations for turbines.

There is a large practice at the present day in the construction of wheels in which the flow is at first inward and then changed to parallel flow. One advantage of these over the inflow wheel is their increased capacity for work.

## Rogers Locomotive Company.

On the 20th day of last month The Rogers Locomotive and Machine Works, of Paterson, N. J., changed its corporate existence and became the "Rogers Locomotive Company."

Mr. J. S. Rogers, son of Mr. Thomas Rogers, the founder of these works, has withdrawn from the presidency, Mr. Robert S. Hughes, for many years secretary and treasurer, assuming that position with the new company.

It will be remembered that this establishment is one of the oldest, if not the oldest in this country, and from the outset established a reputation for good management and excellent workmanship, which has been fully sustained for nearly 60 years.

A curious coincidence is found in the death of Mr. George Hollingsworth in his 87th year, a few days after the above change took place, and who at the time was the oldest living locomotive engineer in this country. Mr. Hollingsworth had been connected with the works from the first.

## Manufactures

The Metropolitan Traction Company, of New York, has purchased land upon which to erect a power plant.

The Chain Belt Co., Milwaukee, Wis., founders, machinists and engineers, issue an illustrated catalogue of chain belts for various purposes, and several tools and machines made at the works.

There is water-works agitation at Marietta, O.; Clarksville, Tenn.; St. Paul, Minn.; New Wilmington, Pa.; Providence, R. I.; Cleveland, O.; Lisbon Falls, Me.; Lexington, Ky.; Union Springs, Ala.

Jonesboro (Me.) people say that it will require 300 men to do the work which is already mapped out for their quarries the coming summer. That will be one of the most prosperous towns in Washington County.

The Brown & Sharpe Mfg. Co., Providence, R. I., are preparing to put up during the coming summer a four-story addition to their works, which will be about 50x200 feet, or over half the length of the present buildings.

Henion & Hubbell, Chicago, Ill., send us an excellently arranged illustrated catalogue of pumps, hydraulic machinery, well tools and supplies, wagon makers' tools, feed cutters, wrought-iron pipe and fittings, brass goods, etc.

We have received a circular from the Almy Water-tube Boiler Co., Providence, R. I., showing Almy's sectional water-tube boiler. The circular is fully illustrated and contains a good deal of information about this boiler.

The Pepperell Manufacturing Company, Biddeford, Me., which has long contemplated an extension to its plant, will undoubtedly build the coming spring, the city having granted exemption from taxation on the proposed improvements.

We are informed that the correct name of the system of sewerage at the World's Fair is not the "Stone system," as was stated in our Chicago correspondence, issue of February 16, but that of the Shone Hydro-Pneumatic Sewage and Water Supply Co.

The Holly Mfg. Co., of Lockport, N. Y., have issued a small illustrated pamphlet, giving an account particularly of the Gaskill-Holly pumping engines. The pamphlet also contains an extensive list of cities in which these and the regular Holly pumping engines are used.

A new manufacturing enterprise has been established in New Bedford, Mass. A company has been formed for the manufacture of all kinds of felt hats, and it will be known as the Enterprise Felt Hat Manufacturing Co. James Rosebottom is the business manager. Work will be commenced at once.

The Builders' Iron Foundry, of Providence, R. I., has received the contract for twenty-eight spring return carriages for 12-inch breech-loading rifled mortars. These carriages weigh about forty-two tons each, and are to be used for coast defence in connection with the rifled mortars made by this company.

The Woodman-Cook Co., manufacturers of silver-plated ware, Portland, Me., has been incorporated with a capital stock of $25,000, paid in $15,000, with the following officers: President, E. B. Cook; vice-president, C. H. Fessenden; treasurer, F. H. Woodman; directors, E. B. Cook, F. H. Woodman, Chas. Cook, C. H. Fessenden, J. F. Woodman.

I. P. Richards, Providence, R. I., has issued a very neat and comprehensive chart of U. S. standard punches and dies for all purposes, including shearing punches for large holes, such as required in tube plates, etc. The illustrations are very fine, and give an idea of the work he does in his line of manufacture. Mr. Richards says he was the first to devise a standard for punches.

The North Shore Traction Co., of Lynn, Mass., have placed the contract for their new car shed with The Berlin Iron Bridge Co., of East Berlin, Conn. The building will be 103 feet in width and 300 feet in length, constructed entirely of iron and brick in order to have the station fire-proof. The same company are also making an addition to a shed for the Wilmington City Railway Co. at Wilmington, Del.

Noyes & Goddard, Waterville, whose stove foundry was recently burned, have just completed their new and commodious plant, which is much larger than the old one. The foundry proper is 40x70 feet, and the mounting room is 30x60 feet. This furnishes sufficient room for more than doubling the original capacity of the plant. It is thoroughly equipped with all the latest improvements in the

line of foundry machinery, and furnishes employment for about twenty men at present, but this force will be doubled shortly.

We have received a new catalogue of the Chandler & Taylor Co., of Indianapolis, Ind., in which is described and illustrated a line of stationary single and duplex link and plain engines of different forms, boilers and other appurtenances of steam plants. The catalogue contains much information that is of use to any one interested in the generation and use of steam for power purposes, and being of standard size, that is, 6x9 inches, is well adapted to be filed either with the publications of the various technical societies or otherwise.

The Frasse Company (successors to Frasse & Co.) advice us that they will move on or about May 1st from 92 Park row, which location they have occupied for over fifty years, to the commodious store at 19 Warren street, where they will show a full line of lathes, shapers, planers and other machinery and mechanics' tools. Their trade has increased to such a degree that this move has become necessary to keep pace with their output. The store will be arranged to accommodate their retail stock. The basement will be fitted up with racks for a stock of square, round, octagon and flat, comprising all sizes of "Poldi" steel, for which they are sole American and Canadian agents. This steel is used for turning locomotive tires and other hard surfaces, and for such works where tools made of regular steels would not hold their edges. They also make a specialty of tools for repairing bicycles.

### Machinists' Supplies and Iron.

NEW YORK, March 4, 1893.

Iron—American Pig—We quote Standard Northern brands, No. 1 Foundry, $14.75 to $15.25; No. 2, $14 to $14.50; Gray Forge, $13 to $14. Southern brands of good quality are obtainable at $14.75 to $15 for No. 1 Foundry; $13.75 to $14 for No. 2; and $12.75 to $13 for Gray Forge.

Antimony—The market is steady. We quote L. X., 10¾c. to 10½c.; Cookson's, 10½c. to 10¾c.; Hallett's, 10c. to 10⅛c., and U. S. French Star, 10¼c.

Copper—The market is quiet. Lake Copper on spot has been offered at 11.85c. to 11.90c. for round lots, but this does not meet the buyers' views, who prefer to await developments. Casting Copper is held at 11c. to 11¼c.

Lead—The market is steady at 3.95c. asked and 3.90c. bid.

Lard Oil—Prime City is quoted at $1.07½ to $1.08.

Spelter—The market is unchanged and dull at 4.27½c. to 4.30c. for New York delivery. A few lower bids have not been accepted.

Tin—The market is quiet and uncertain. The spot on stock and afloat is under good control, and rather firmly held at 20.35c. for March and 20.40c. for April deliveries. For spot delivery 20.25c. is bid; not entertained.

## WANTED

*"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.*

Wanted—Salesmen on commission, to push a special line of mach'y. "Kirk," care of AM. MACH.

Designer and draftsman, technical graduate, with shop exp., wants position. Box 24, AM. MACH.

Pattern maker of 11 years experience wishes position in the South. Address P., AM. MACHINIST.

Mech. draftsman & designer (28) graduate, 13 yrs. experience, wants position; ref. Box 43, AM. MACH.

Wanted—Position as foreman of shop running 25 to 50 men; well up on jig and interchange methods; references. Address Energy, AM. MACHINIST.

A first rate tool maker wants situation; is a successful designer of tools to reduce cost of manufacture; best reference. Box 30, AM. MACHINIST.

Wanted—First-class machinist, at good wages; steady employment; must be used to job shop work. Address Box 34, AMERICAN MACHINIST.

Wanted—Good machinists on vise and floor work in the printing press department of Mason Machine Works, Taunton, Mass.

A 1st-class pattern maker, 20 years' experience, open for engagement April 1; $100 per month if you want a pusher. Pattern Maker, AM MACH.

Wanted—Foreman for machine shop for a car works; must be under 40 years of age. Address V. 5, care Lord & Thomas, Chicago, Ill.

Wanted—Position by draftsman on steam engine, special tools, jigs, etc.; good shop experience. Address E. X. K., AMERICAN MACHINIST.

Wanted—By a thorough practical machinist and tool maker a situation as foreman; aged 33; strictly temperate; can furnish best ref. E. E. B., AM. MACH.

Wanted—Position as sup't or ass't; good manager of men and a pusher up in modern methods, eng., mach. tools, heavy electrical work, etc. Box 37, AMERICAN MACHINIST.

An accurate and thorough mechanic, experienced in all branches, has filled the positions of master tool maker, foreman and sup't; is at present disengaged; best of refs. Box 38, AM. MACH.

Wanted—By practical foundry foreman (30,) situation; large experience in marine and general engine castings, loam and dry sand work; good recommendations. Foundryman, Box 29, AM. MACH.

Wanted, immediately—Two good molders for dry and green sand work; also good lathe and planer machinists for shop building steam engines. Address Box 40, AMERICAN MACHINIST.

Wanted One first-class man to run turret lathe; good wages; steady employment; pleasant locat'n; must be steady and reliable. Address Manufacturer, Box 36, AMERICAN MACHINIST.

A competent mechanical engineer, original designer and inventor, desires engagement as sup't or chief engineer with a good concern; experienced in handling men and work systematical. Address Engineer Box 35, AMERICAN MACHINIST.

Wanted—Foreman for machine shop manufacturing wood-working machinery; must be a good mechanic, and well acquainted with modern machine shop practice; state age, experience, and salary expected. Address I., Box 26, AM. MACHINIST.

Wanted—A foreman for machine shop in Western Pennsylvania manufacturing portable engine and gen. machine work; must be thoroughly up in modern machine shop practice and understand methods of producing work cheaply; give reference, age and salary expect'd. Box 39, AM. MACH.

Machinist and draftsman (designer) 3½ years in this country, who is master of 4 languages, wishes to represent or act as interpreter for one or several concerns at the Columbian Exhibition; had a similar position at the Paris Exposition of 1889; can give first class American and foreign references. Address L. E. F., AMERICAN MACHINIST.


# Bradley Hammers.

If you plate, draw, square, taper, swage, collar, spindle, or do any manner of die forging in iron or steel, a BRADLEY HAMMER will soon pay for itself, by what it will save over any other similar tool. Send for circulars.

BRADLEY & COMPANY, SYRACUSE, N. Y.

Flexible Metallic Fillet

For Pattern Makers. 8 Sizes.

H. WHITE, 44 N. 4thSt. Phila, Pa

HEAT BUILDINGS BY

# BOSTON HOT BLAST APPARATUS

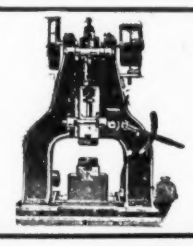
Blowers and Exhausters for every duty—Dry Kiln Apparatus.

**BOSTON BLOWER CO., Boston, Mass.**

# HACKNEY HAMMERS

Meet all requirements more fully and satisfactorily than any other of its competitors.

INVESTIGATION IS NOT COSTLY.
INVESTIGATION IS CONVINCING.



WRITE FOR CATALOGUE TO
THE HACKNEY HAMMER CO.
20 Johnson St., CLEVELAND, O.

# EXPERIMENTAL ENGINEERING,

BY

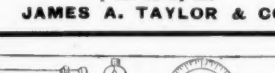
Prof. ROLLA C. CARPENTER, M. S., C. E., M. M. E.

8vo. Cloth, $6.00.

JOHN WILEY & SONS, NEW YORK.

Philadelphia
Geo. B. Grant's new
gear shop is at
125 South 11th St

American Standard Gauge & Tool Works,
WILMINGTON, DEL.



# ADJUSTABLE BLADE REAMERS,

¼ in. to 2½ in.

JAMES A. TAYLOR & CO.

HOW TO COMPUTE THE HORSE POWER OF A STEAM ENGINE.
Use the Average Steam Pressure and Horse Power Indicator, which give it at once for any **Cut-off.** Price, $2.00. Published by KEUFFEL & ESSER CO., New York, (Branch, Chicago). Drawing Materials and Surveying Instruments.

# STAR POWER HACK SAW.

The use of Hack Saws for cutting metals has increased a thousand fold, at least in the last ten years, or since the Star blades were first introduced. Before that time England furnished most that were used. Now the world's supply is made in this country. We handle nearly all that are made and know that the demand doubles every 28 months.

About two years ago we begin making a Power Frame for these Star blades, which has proved to be a very great success. The speed and pressure is so regulated that one blade will cut all day long, or say, ten times as much as when used in a hand frame. It will cut all metals up to 4½ inches, round or square, requiring no attention after the work is put in the vise. We can give the names of several thousand Iron Workers who are using these Power Saws, and we think they will all say that the machines are worth to them a great deal more than they cost. It is only a question of a very short time when all iron working shops will have from one to a dozen of these saws in use **Price, $25.**

We are the only Headquarters for Star Hack, Butcher and Bracket Saws.

**MILLERS FALLS CO.,**
93 READE ST., NEW YORK.

FOR SENDING

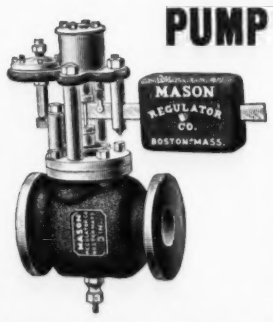
# CIRCULARS TO MACHINISTS AND ALL METAL WORKERS.

Directory giving names, addresses (Street numbers in Cities), and Commercial ratings of all Machinists, Founders, Engine Builders, Boiler Makers, Machinery Manufacturers and Dealers, Iron and Steel Dealers, Supply Dealers, Plumbers, Steam and Gas Fitters, Sheet Metal Workers, and all other Manufacturers and Dealers connected with the Machine, Iron, Steel and Metal working trades in the United States.

Gives more information than any other one publication. Accurate, Complete and Condensed; saves time and postage. Price reduced to $5.00. Never before offered at less than $10.00. A limited number of copies remain.

**MACHINISTS' REFERENCE DIRECTORY, 119 South 4th Street, PHILADELPHIA.**

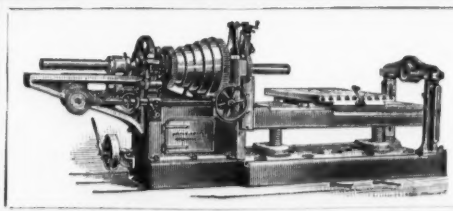
## A NEW STYLE
## PUMP PRESSURE REGULATOR.




This is a Pressure Regulator, especially designed to meet the requirement of Steam Pumps in Elevator service.

The lever bearings are hung on hardened steel knife edges, which makes the Regulator in its working as sensitive as a pair of scales.

**MASON REGULATOR CO.,**
BOSTON, MASS., U. S. A.



**BETTS MACHINE CO.,**
WILMINGTON, DEL.

## MACHINE TOOL BUILDERS.

IMPROVED PATTERNS! LATE DESIGNS!

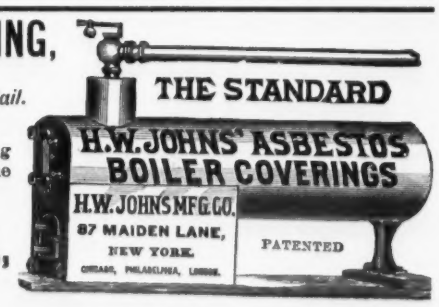
# ASBESTOS CEMENT FELTING,

FOR LAGGING LOCOMOTIVE BOILERS.

*Samples and Descriptive Price List Free by Mail.*

We are prepared to take Contracts for applying Steam Pipe and Boiler Coverings in any part of the United States.

**H. W. JOHNS MANUFACTURING CO.,**
87 Maiden Lane, NEW YORK.



Wanted—A foreman for a fine brass foundry near New York; must be skilled in making the highest grade of small brass and bronze castings, such as for hardware and fancy goods, and competent to take charge of finishing and pattern making. Address, stating age, experience, references and salary expected, Box 42, American Machinist.

A permanent position, with good pay, is open to a first-class, all-around machinist; preference will be given to a man capable of making good working drawings and governing a few men in new works now being equipped with modern tools for the manufacture of pressure regulators, reducing valves, pump governors, etc.; communications will be treated as confidential and returned if desired. Address Foster Engineering Co., Newark, N. J.

## ✢ MISCELLANEOUS WANTS ✢

*Advertisements will be inserted under this head at 35 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.*

Cheap 2d hd lathes & planers. S. M. York, Clev'd, O.

Auto. Steam Flue Cleaners. Kelley Co., Erie, Pa.

For Sale—Second-hand drill presses, engine lathes and planers. Dietz, Gang & Co., Cincinnati, O.

Light and fine machinery to order; Foot Lathe Catalogue for stamp. E. O. Chase, Newark, N. J.

Engines, special and gen. mach'y designed; ideas developed. A. W. Jacobi, 136 Liberty St., N. Y.

Best Bolt Header in the world for $50. Address C. H. Baush & Sons, Holyoke, Mass.

Wanted—To buy or rent a small machine shop and foundry; give full partic's. Box 41, Am. Mach.

For Sale—A machine shop, well established in a city in Central Pennsylvania. Price, $3,500. Want inquiries from parties meaning business. Address P. O. Box 27, Harrisburg, Pa.

Special, experimental or other light machinery manufactured. Best equipped shop in the West for fine work. Manufacture one of the best hollow spindle bench lathes for the tool room or for manufacturing. Write us. Moseley & Co., Elgin, Ill.

Agents wanted in every manufacturing town in the country; a first class mechanic who will devote his spare time to solicit orders on commission for an established business; must be a hustler; samples furnished. Address Box 566, Waterbury, Conn.

For sale, for want of use, Herreshoff improved water-tube boiler in perfect order, 5½ feet by 5½ feet by 6 feet, with usual fixtures; price low for cash. W. H. Hoyt & Son, Box 765, South Norwalk, Conn.

Wanted—To sell one of the most complete foundry and machine shop plants west of the Mississippi, located in the best town in the West; this plant is equipped with modern machinery and of large capacity; originally established in 1867; reason, wish to retire from business. R. L. Cofran, Topeka, Kan.


WE ARE

**GENERAL EASTERN AGENTS**

FOR

G. A. GRAY CO.'S Planers,
The Celebrated MULLER Lathes,
W. F. & JNO. BARNES CO.'S Drills and Lathes,
KELLY Adjustable Crank Shapers,
SMITH & SILK Crank and Geared Shapers.
DIETZ, GANG & CO.'S Radial Drills.

AND LOCAL SELLING AGENTS FOR

P. BLAISDELL & CO.'S Lathes and Drills,
HENDEY MACHINE CO.'S Lathes and Shapers,
GEO. H. EATON & CO 'S Power Presses and Shears,
SLATE MACHINE CO.'S Sensitive Drills,
DIAMOND MACHINE CO.'S Grinding and Polishing Machinery.

A Large Stock Always on Hand.

**THE GARVIN MACHINE CO.,**
LAICHT & CANAL STS.,
NEW YORK.

**SECOND-HAND AND NEW MACHINERY**

62 in.x61 in.x9 ft. Planer 2 Heads.
54 in.x42 in.x24½ ft. do 2 do
42 in.x42 in.x16 ft. do 1 do
30 in.x30 in.x8 ft. do 1 Head.
26 in.x24 in.x7 ft. do 1 do
25 in.x24 in.x5 ft. do 1 do
23 in.x21 in.x5 ft. do 1 do
15 in x13 ft. Planer New Haven.
80 in.x18 ft. Engine Lathe Geared Face Plate.
60 in.x45 ft. Double Engine Lathe.
52 in x35 ft. Engine Lathe Horizontal Boring Machine, one end.
30 in.x28 ft. Pond Machine Tool Co Shafting Lathe.
32 in.x26 ft. D. W. Pond Engine Lathe.
32 in.x12, 14, 16, 18 ft. Bed. New Engine Lathe.
28 in.x22 ft. Engine Lathe cheap.
25 in.x12, 16, 20 and 24 ft. Bed. New do do do
21 in.x10, 12 ft. Bed. do do do
20 in.x7½ & 8 ft. do 2d Hand do do
18 in.x 6, 7 & 8 ft. do New & do do do
17 in.x 8 ft. do do do do
16 in.x 6 & 8 ft. do do do do do
15 in.x 6 & 8 ft. do do do do do
14 in.x 6 ft. do do do do do
Car Axle Lathe, Bement.
15, 16, 18, 25 in. Crank Shapers.
20, 24, 26 & 30 in. Geared Shapers.
20, 22 24, 28, 30 & 36 in Drills.
Bolt Cutters.
8 and 13 in. Stroke Slotters.
Lot of Lincoln Pattern Millers.
2 3 and 4 Spindle Drills. Garvin.
No. 75 Bliss Presses.
Boiler Head Flanging Mach. O'Brien's Gear Molding Mach.
1100 and 3000 lb. Bement Steam Hammer.
100 and 150 lb. Steam Hammer.
40 H. P. Vert. Engine. N. Y. S. S. P. Co.
11 in.x18 in. Hor. Engine. At Order.
12 in.x24 in. and 14 in.x36 in. Corliss Engines.

No. 0 Turret Lathe, Am. Tool and Mach Co., 24 in. Swing, 8 ft. Bed.

SEND FOR MARCH LIST.

**GEO. PLACE MACHINE CO.,**
120 BROADWAY, NEW YORK.

**SOFT GRAY IRON CASTINGS.**

From ⅛ oz. to 1000 lbs. Small Castings a Specialty. Light machinery wanted to build.

**ONTARIO IRON WORKS,**
CANANDAIGUA, N. Y.

Liberal inducements to Agents.

**SLIDING CALIPERS are the best Measuring Instrument made, give them a trial and be convinced.**

Hardened Jaws; graduated in 1-100th and 1-64th or 1 32d and 1-16th, warranted first-class and accurate.

Vernier and Metric Measurement to Order.

Prices are low *and you cannot afford* to be without one. Ask your dealer for it, or send for circulars and prices to

**E. C. SMITH, Columbia, Pa.**

FOR SALE

**Entire Equipment Machine Shop,**

CONSISTING OF THE FOLLOWING

**Machine Tools used on Tool Work, in First-Class order and Complete.**

**Engine Lathe,** 25 in. swg. 5½ ft. between centers. Hollow spindle 1¾ in. and cross-feed.
**Engine Lathe,** 24 in. swg. 5½ ft. between centers. Hollow spindle 1¾ in. and chuck.
**Engine Lathe,** 18 in., swg. 5 ft. Bed with hollow spindle 1¾ in. and chuck.
**Planer,** 24 in. x 5 ft. with all the feeds and chuck. "New Haven."
**Planer,** 30 in. x 8 ft. "Extra Heavy" with all the feeds. Used one week.
**Shaper,** 15 in. stroke, with improved tilting table "Hendey."
**Upright Drill,** 30 in. swg. with backgears, automatic feed lever feed and reverse motion for tapping. "Extra Power."
**Upright Drill,** 32 in. swing complete.
**Brown & Sharpe,** Upright Turret Machine complete.
**Speed Lathe,** 10 in., swg. 4 ft. bed.
**Punch Presses,** regular styles, common sizes.
**Springfield Tool Grinder.**
**Boiler Bending Rolls,** 8 ft. 2 in., improved style, with balanced top roll and hinged housing.

**J. J. McCABE,**
SUCCESSOR TO
E. P. BULLARD'S
N. Y. Mach'y Warerooms.
68 Cortlandt Street,
NEW YORK.

**JESSOP'S STEEL**

FOR TOOLS, DRILLS, DIES, &C.

ALL KINDS IN STOCK.
Manufactory, SHEFFIELD, ENG.
Chief Am. Office, 91 JOHN ST., N. Y.
WM. JESSOP & SONS, LD.
Established a century ago.

**No. 1 TRAVELING CRANE.**
CAPACITY, 3,000.
On Wood
Overhead Beams.
PRICE OF MACHINE, - - $100.00
Timber, Bolts, Track Iron for overhead frame, 11.50
Send for Illustrated Circular, giving full details.

**T. SHRIVER & CO.** 333 E. 56TH ST. NEW YORK.

**Experimental Work of every Description,**

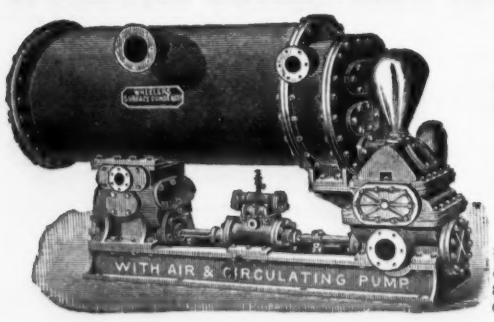
Mechanical and Electrical. Contractors for the manufacture of specialties, or can furnish complete plants for their manufacture. Make Dies, Special Tools, Gauges, Drawings, Patterns, Models. Inventions perfected. Estimates furnished. Correspondence solicited.

Send for Circular of our SENSITIVE KNEE DRILL.

**BRADY M'F'G. CO.** 83 Washington St., BROOKLYN, N. Y.

**WHEELER CONDENSER AND ENGINEERING CO.**

92 & 94 Liberty Street, New York.

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**SURFACE CONDENSERS.**

ALSO SUCCESSORS TO THE

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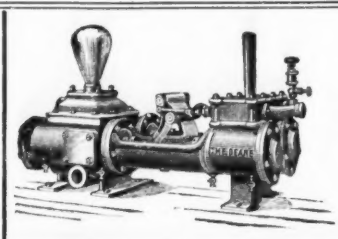
Machinery for Sugar Plantations and Refineries. Vacuum Pans, Double and Triple Effects, &c. Blowing Engines for Blast Furnaces. Iron and Brass Castings for the Trade. Heavy Machinery a Specialty.



**THE DEANE**
OF HOLYOKE
**STEAM PUMPS**
DEANE STEAM PUMP CO.,
HOLYOKE, MASS.

CRESCENT STEEL CO.
PITTSBURGH, CHICAGO NEW YORK.

STEEL OF THE FINEST QUALITY MADE FOR
**DIES, PUNCHES, MILLING CUTTERS, TAPS, REAMERS,**
AND OTHER FINE TOOLS REQUIRING GREAT ENDURANCE OF CUTTING EDGES.

**A NEW SCREW PLATE.**

**THE HANDIEST PLATE MADE.**

THE FULL MOUNTED LIGHTNING.

These Plates have a stock with each die. The dies are our celebrated Adjustable **Lightning** Dies. Each Stock is of correct length and weight to suit size of die. Several sizes of dies may be in use out of same set at same time. SEND FOR CATALOGUE. Made by

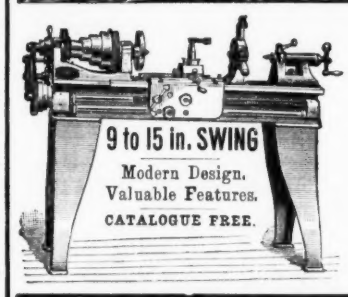
**WILEY & RUSSELL MFG. CO.,**
GREENFIELD, MASS., U. S. A.

**"R. MUSHET'S SPECIAL STEEL"**

SAVES LABOR in being able to run at GREATLY INCREASED SPEEDS. FEWER GRINDINGS. No WASTE in redressing.

SOLE REPRESENTATIVES IN THE UNITED STATES,

**B. M. JONES & CO.,**
BOSTON: 11 & 13 Oliver St. NEW YORK: 143 Liberty St.

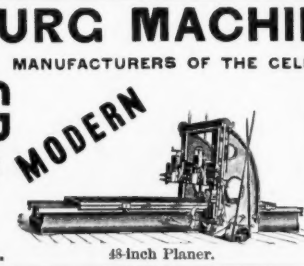



**SEBASTIAN LATHE CO.**
117 & 119 Culvert St., Cincinnati, O.
*Manufacturers of Foot and Power*
**ENGINE AND SPEED LATHES,**
For General Machine and Jobbing Shop, Electrical and Experimental Work.
DEALERS IN MACHINISTS' TOOLS AND SUPPLIES.

**FITCHBURG MACHINE WORKS,**

MANUFACTURERS OF THE CELEBRATED

**FITCHBURG** AND OTHER **MODERN ENGINE LATHE**



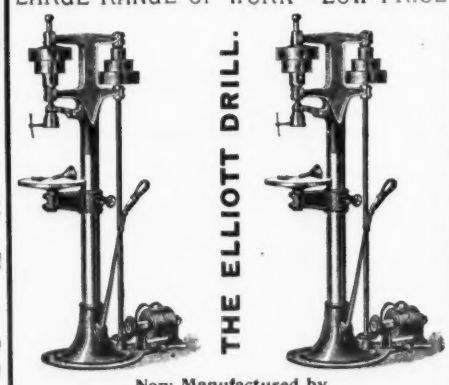
48-inch Planer.

METAL-WORKING MACHINES,

SEND FOR CATALOGUE E.

FITCHBURG, MASS.

**The Elliott Drill Press**
FOR ANY LIGHT WORK
LARGE RANGE OF WORK - LOW PRICE




Now Manufactured by
A. J. WILKINSON & CO.,
180 to 188 WASHINGTON ST., BOSTON, MASS.
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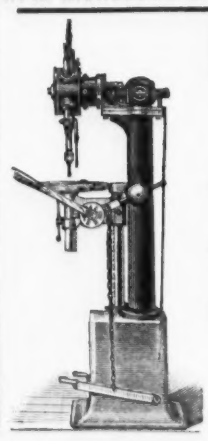

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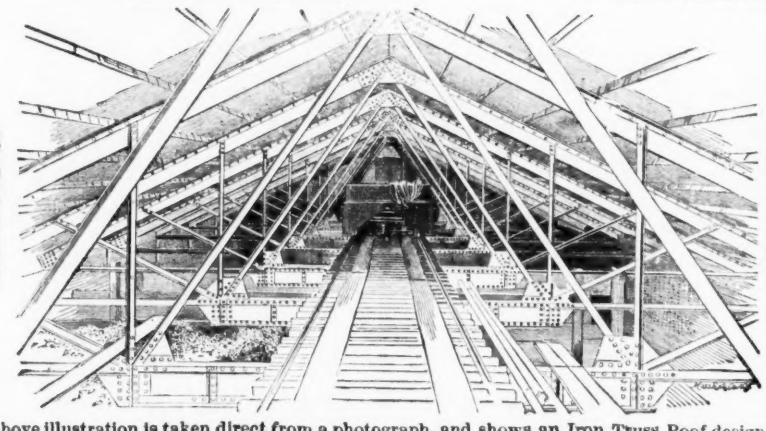

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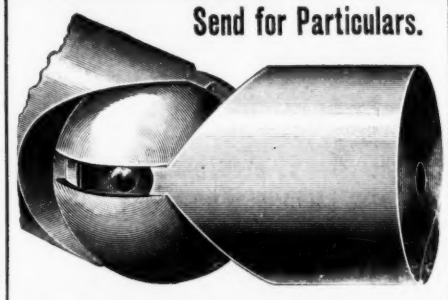

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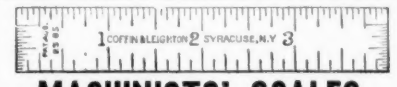


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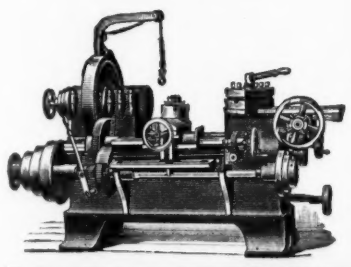

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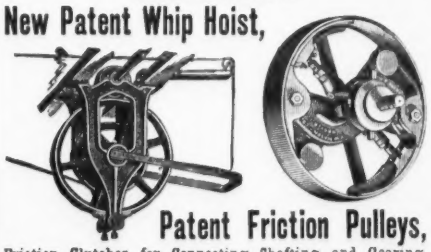

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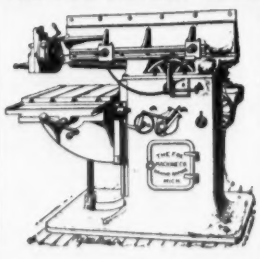

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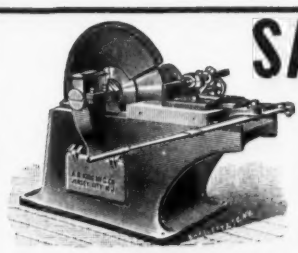

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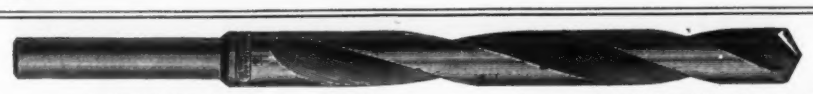

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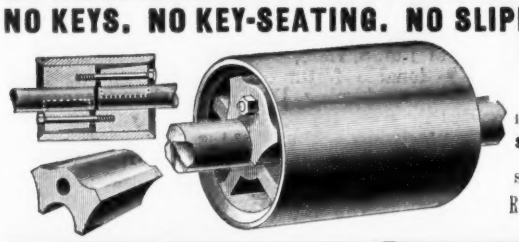

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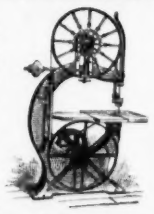

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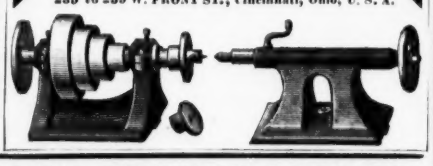

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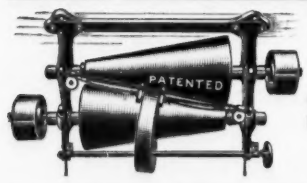


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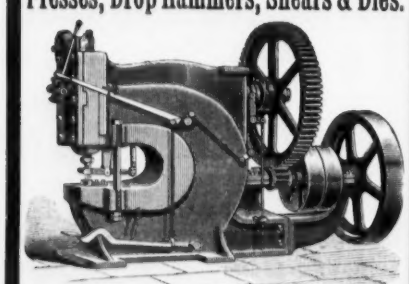

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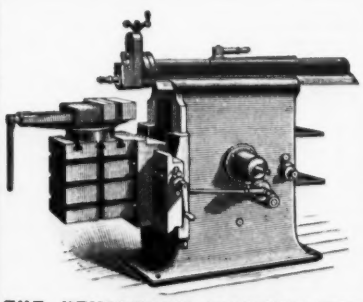

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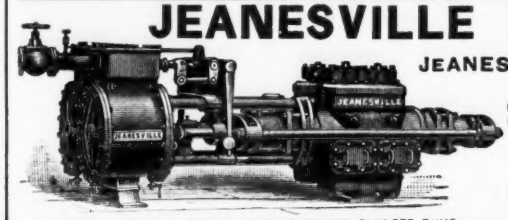

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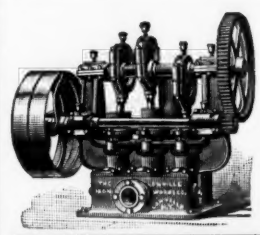

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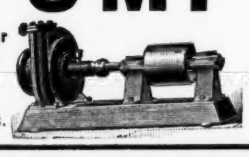

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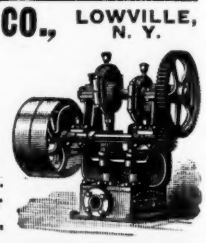

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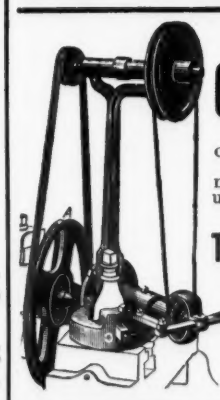

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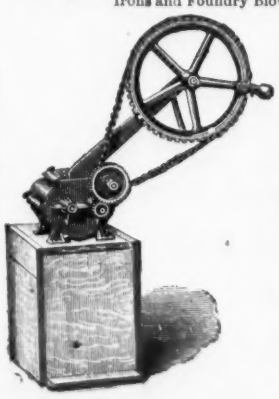

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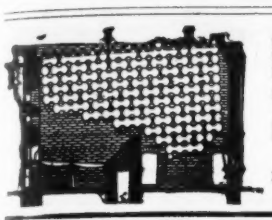

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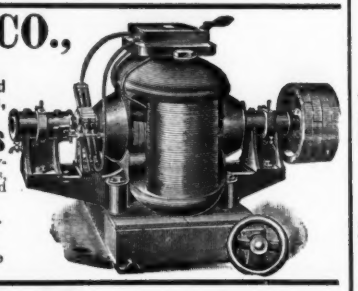

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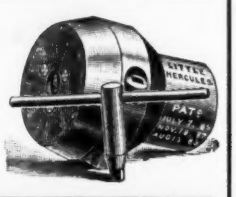

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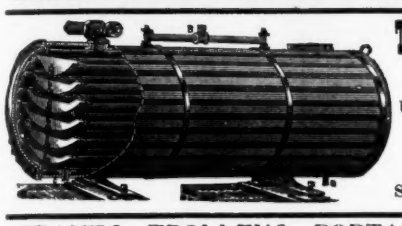

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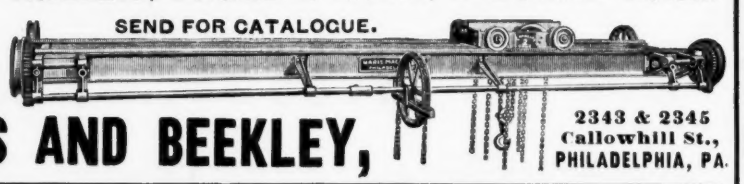

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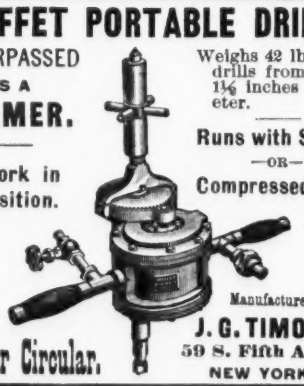

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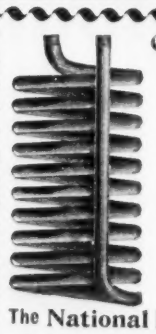

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| 24 in. | 30 in. |
| 30 in. | 36 in. |
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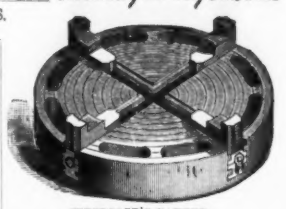

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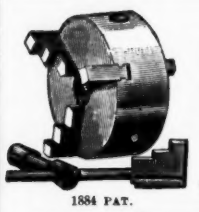

1884 PAT.

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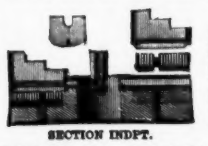

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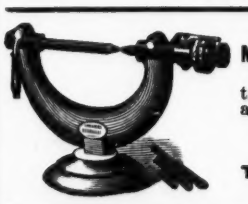

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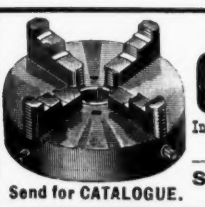

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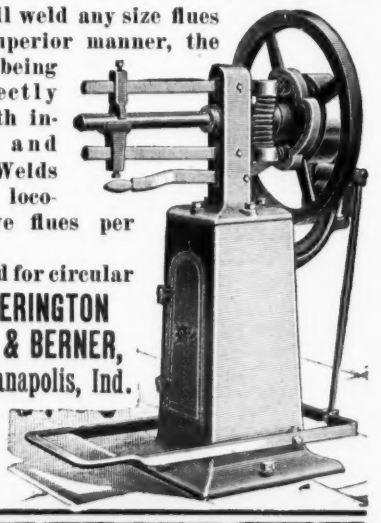

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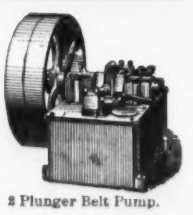

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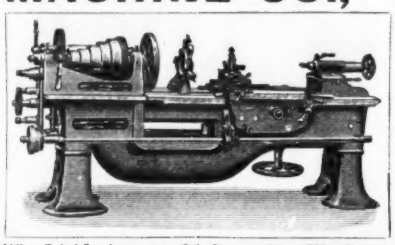

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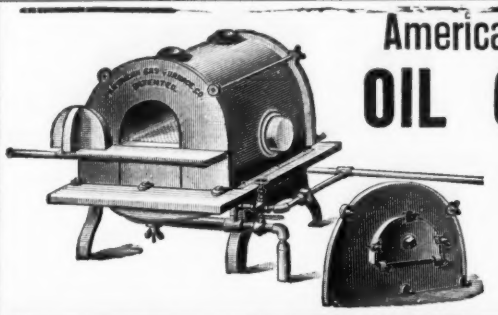

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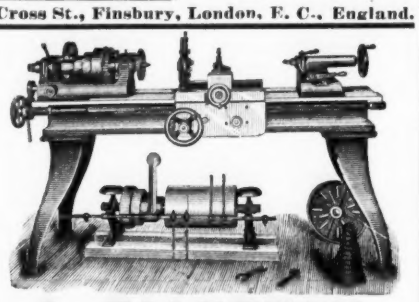

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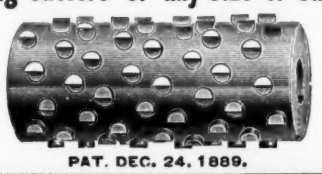
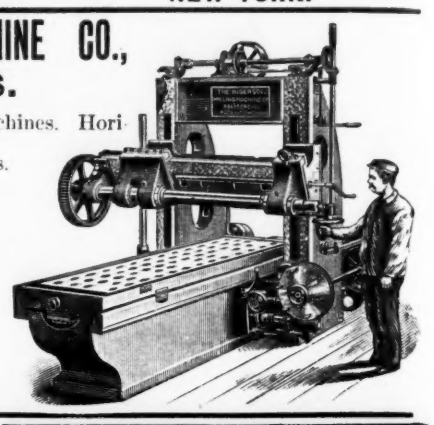


PAT. DEC. 24, 1889.



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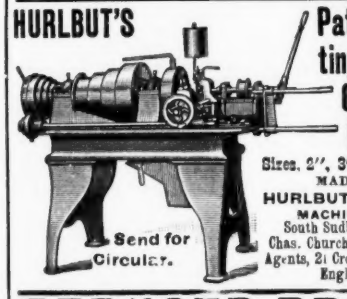

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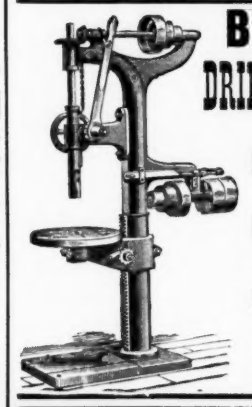

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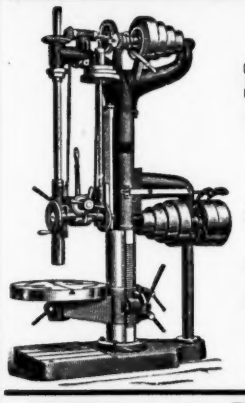

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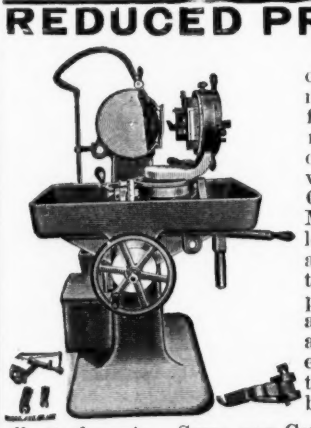

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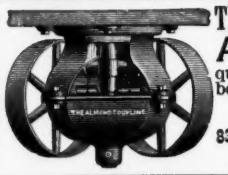

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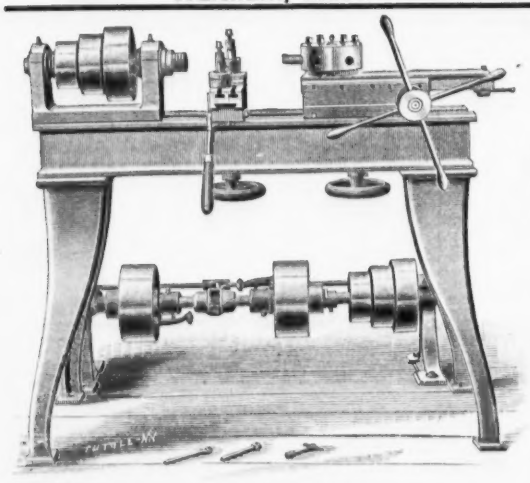

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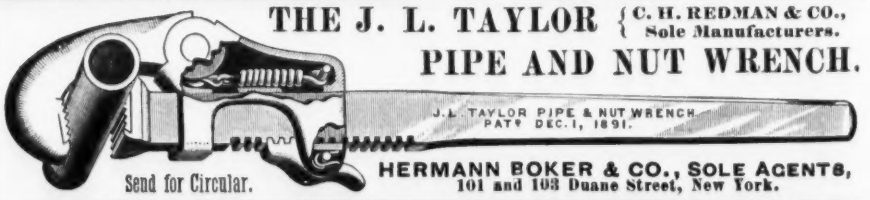


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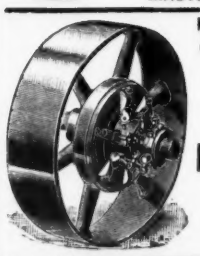

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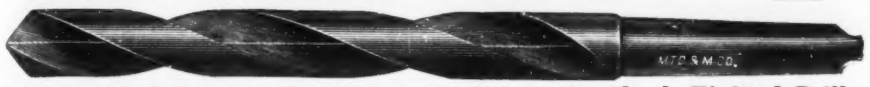

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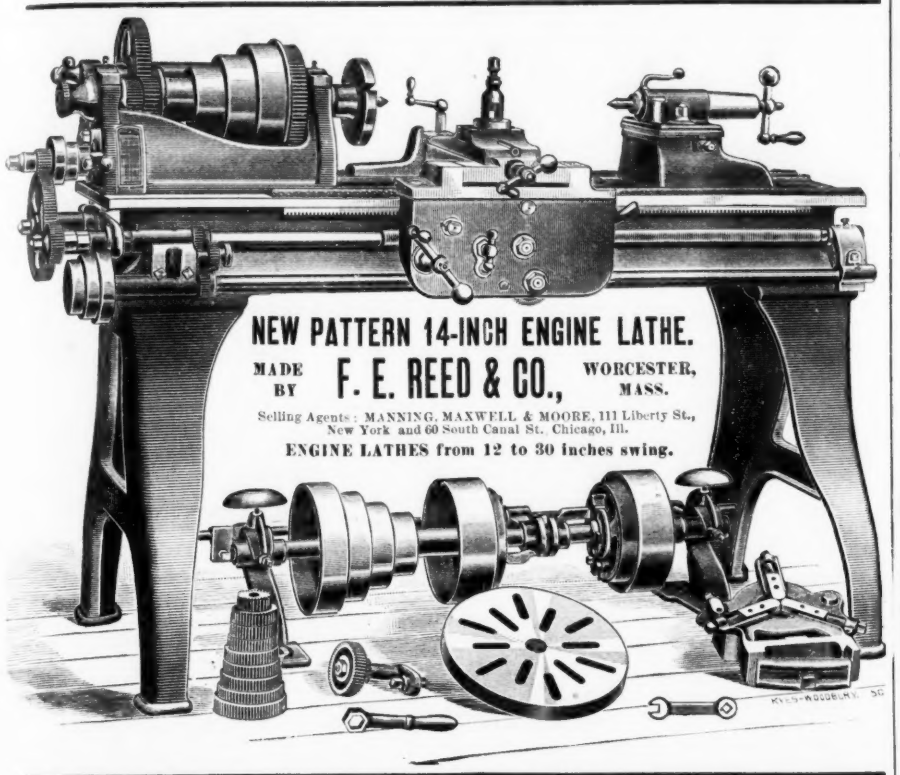
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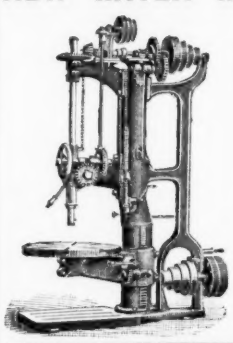

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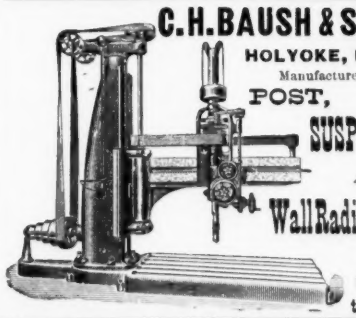

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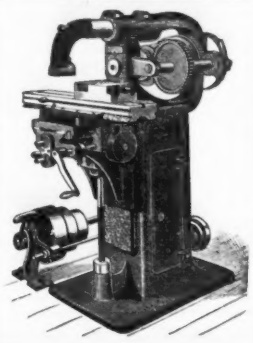

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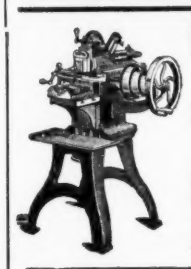

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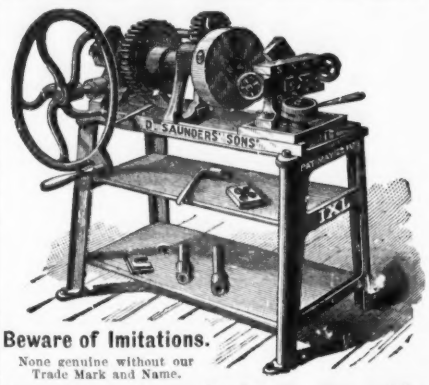


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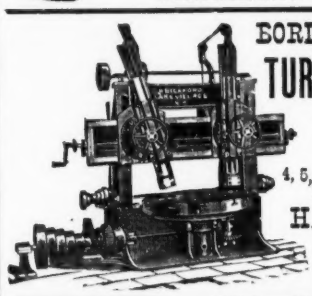

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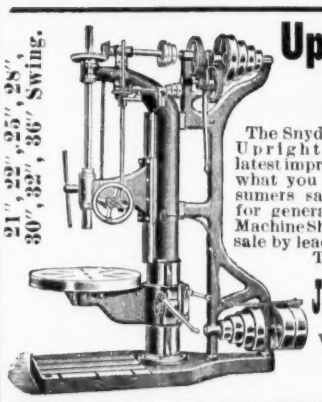

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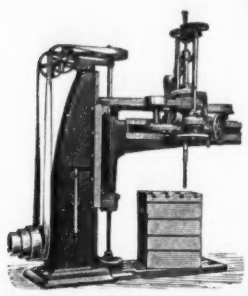

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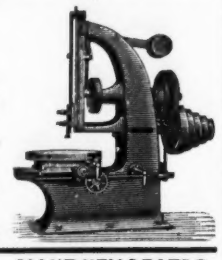

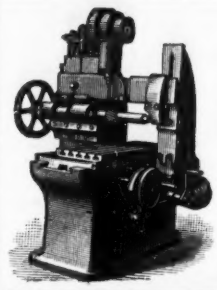

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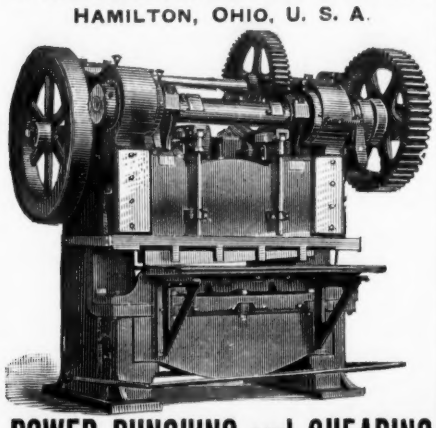

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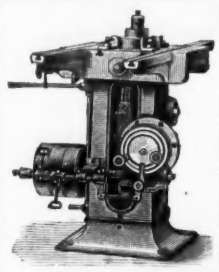

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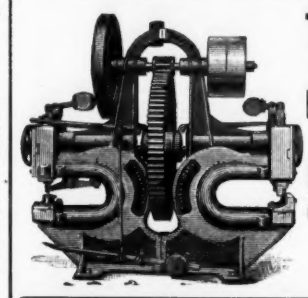

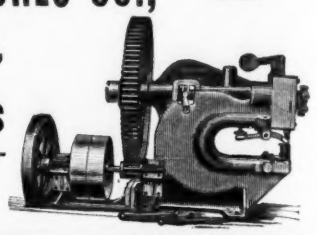

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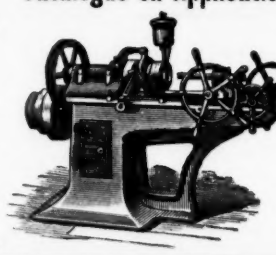

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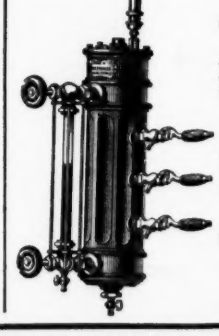

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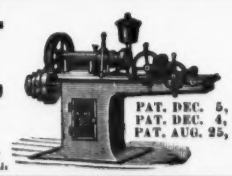


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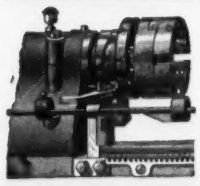

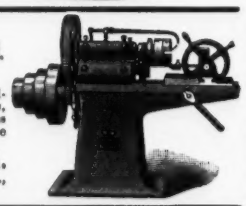

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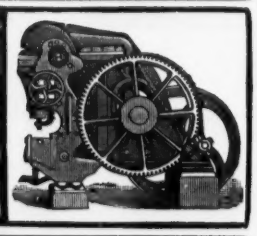

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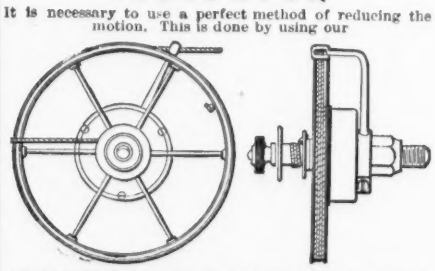

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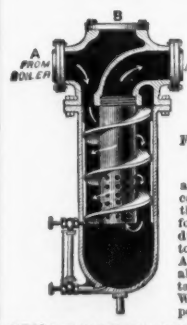


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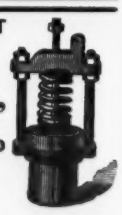

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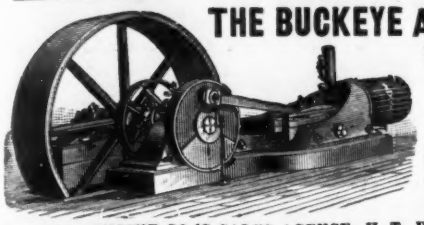

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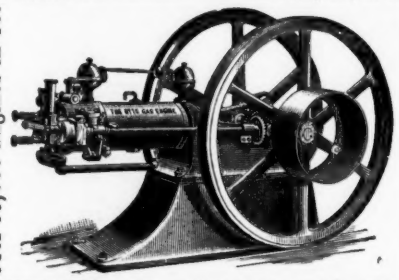

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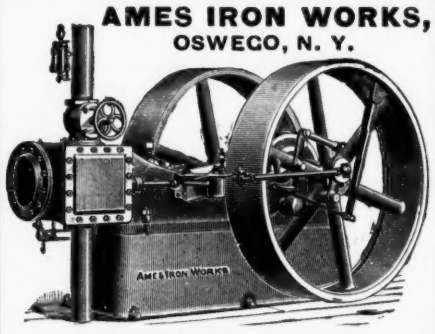

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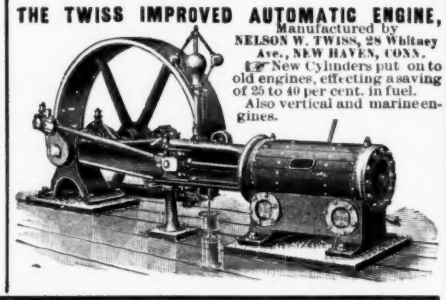

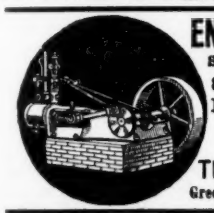

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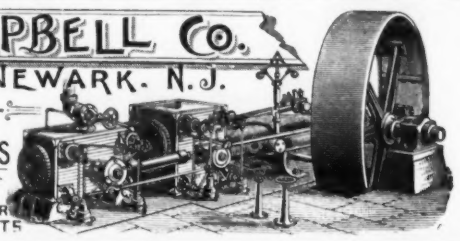

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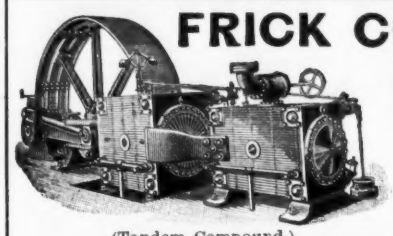

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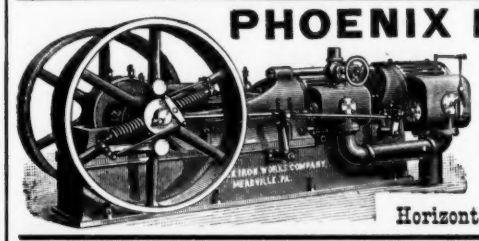

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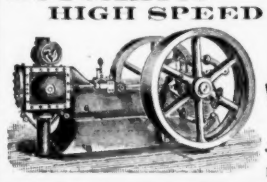

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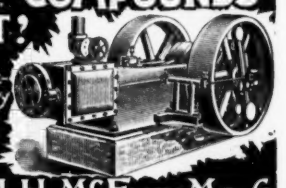

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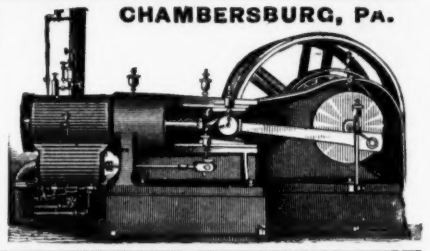

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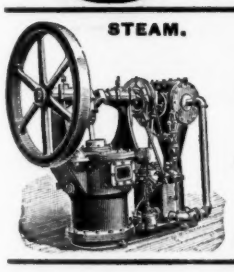

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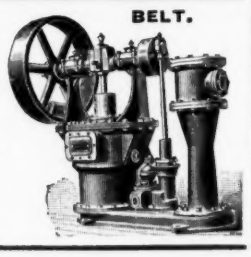

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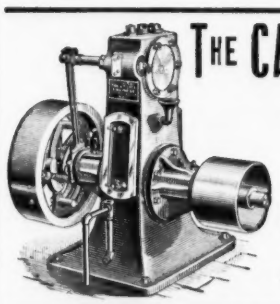

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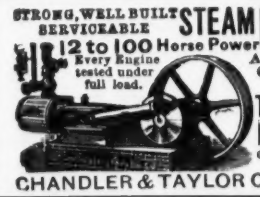

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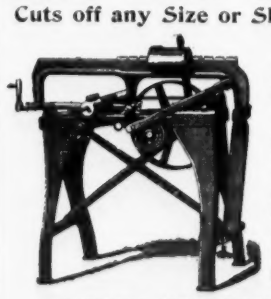

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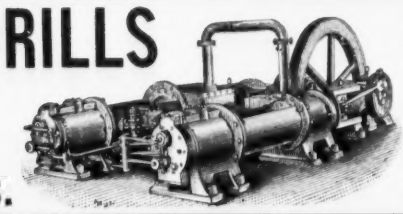

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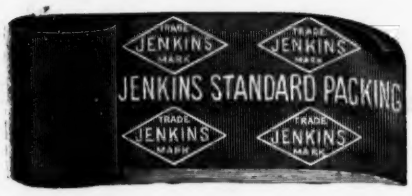


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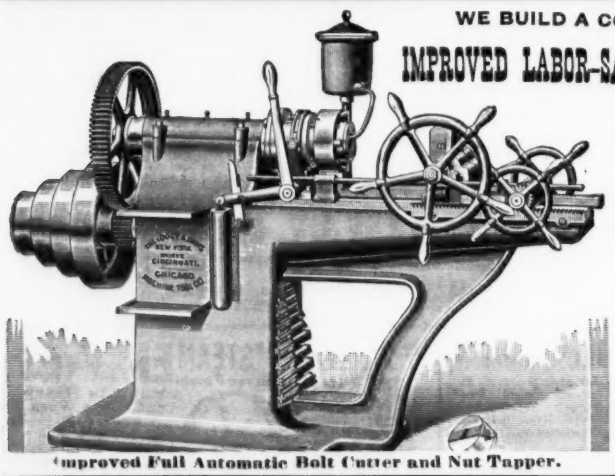

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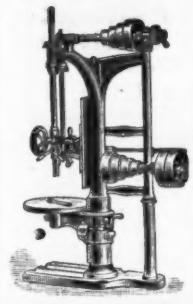

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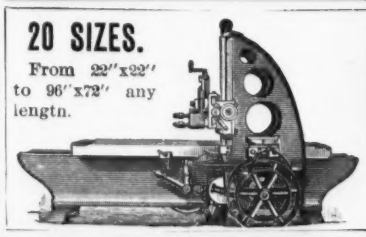

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